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MAR 24 1931

ELECTRICAL WORLD

MARCH 21, 1931

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TIMKEN HAS A BEARING ON YOUR TELEPHONE

The telephone rings. You pick up the receiver. "Hello...yes, this is..." And so it goes, countrywide, millions of times a day.

Half way 'round the block or half way 'round the world, the clear transmission is always the same.

In the mines where the ore is obtained, in the rolling mills where countless miles of cable are made and in the fabrication of the many intricate parts that enter into the construction of telephone apparatus—Timken Bearings are used to keep costs down.

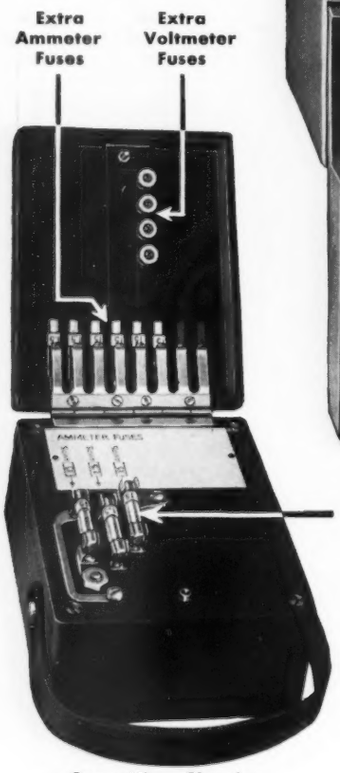
For in all types of machinery, Timken Bearings mean a new era of friction freedom; wear prevention; power and lubricant economy. High upkeep costs vanish. Machines operate at increased productiveness for many additional years. The Timken Roller Bearing Company, Canton, Ohio.

This advertisement, directed to the general public, will appear in The Saturday Evening Post and Collier's on March 28.

TIMKEN *Tapered Roller* **BEARINGS**

Fuse Protected

Model 540



Open View Showing Fuse Compartment

FUSE protected! Weston model 540 six range D. C. Volt-ammeter now embodies the most advanced construction in portable testing instruments! Each range is protected from overloads by independent replaceable fuses.

This new feature makes Model 540 even more valuable to railways, educational institutions and industrial plants who find extensive use for this handy, compact, pocket-size instrument.

Model 540's movement can not be "burned out" by overloads—no matter how inexperienced the operator. In the field, the fuse protection assures active, continuous and dependable service from all ranges. Besides, it cuts down instrument repair bills.

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In this fuse protected Model 540, Weston offers a decided and unusual advantage to users of small, portable, multi-range D. C. instruments.

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WESTON ELECTRICAL INSTRUMENT CORP.

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A consolidation of Electrical World, Electrical Engineer and American Electrician

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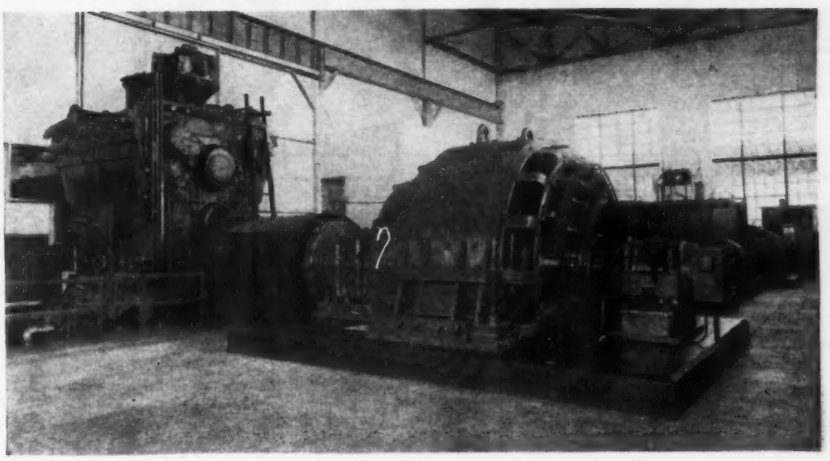

4,000-hp. motor for 98-in. universal plate mill, Gulf States Steel Company

MARCH 21, 1931

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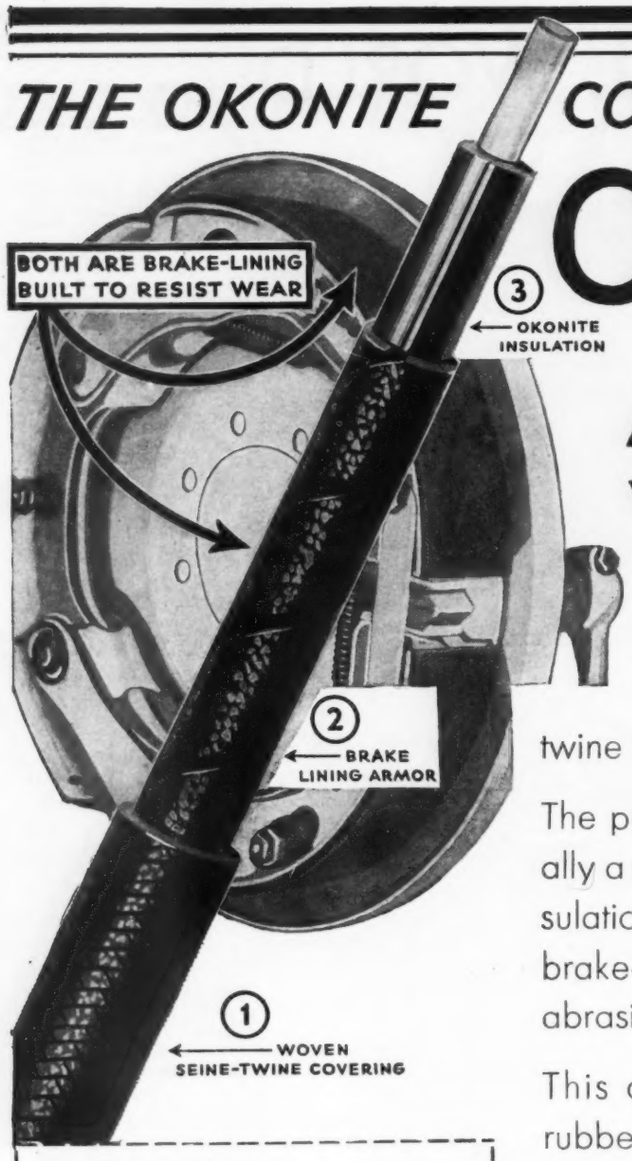
THE OKONITE COMPANY ANNOUNCES

OKOLAST

(IT LASTS)



A Tree Wire Armored with Brake-Lining . . .

The abrasion-resistant outside covering (1) of OKOLAST is a very tough impregnated fabric of specially treated seine twine and is proof against the elements.

The protective armor (2) of OKOLAST is actually a special brake lining wrapped over the insulation to protect it from wear. Like automobile brake-lining it is made to stand almost endless abrasion.

This combination added to the OKONITE rubber insulation (3) gives a three-fold protection against the severe service to which tree wire is subjected.

Filling out and mailing the coupon at the left will bring you a sample of this super tree wire and descriptive bulletin.

THE OKONITE COMPANY
PASSAIC, N. J.

Gentlemen:

I want to see how brake-lining is applied to your OKOLAST TREE WIRE to protect it from wear. Kindly send me a sample cut back to show how it is made.

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Department _____

Company _____

Address _____
No. and Street City State

E. WORLD 3-21-31

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Founded 1878

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Victor G. Mendoza Co., Havana

ELECTRICAL WORLD

for the Week Ending

March 21, 1931

These really are good times, but only a few know it. The average man won't do a day's work unless he is caught and cannot get out of it. There's plenty of work to do if people would do it.

HENRY FORD.

Niagara Power books to be opened

—**Niagara Falls Power group** yields to request of Federal Power Commission for permission to examine books after deadlock of several years. Company reserves right to contest valuation—*p. 522.*

—**London attacks ash problem,** as engineers install elaborate washing systems to eliminate dust and noxious gases. Present costs are high but experiments are encouraging—*p. 542.*

N. E. L. A. plans for Atlantic City

—**Adopt employee benefit plans** to stabilize employment and provide insurance and retirement funds. Electrical manufacturers are active to keep pace with the trend of the times—*p. 537.*

—**Economy of automatic control** proved by experience at California hydro-electric stations. Plants pay for themselves in five and a half years as labor cost and housing expense is cut 57 per cent—*p. 532.*

—**Manufacturers' 1930 reports.** General Electric and Westinghouse, taking stock of events in gloomy year, find encouragement. Former had second largest year in history; latter maintained five-year average—*pp. 560, 561.*

Hoover Dam suit hearings closed

—**Hoover Dam hearing closed** after review of evidence offered by Arizona and opposing parties. Decision of U. S. Supreme Court rests upon constitutionality of the project which Arizona has long attacked—*p. 523.*

—**Executive hurls the gauntlet** and calls for open war on the detractors of the industry. Vice-president Mullendore of California Edison calls it "political sabotage"—*p. 547.*

—**Electrical advertising digs in** for a stand on its rights. Industry group, while not unanimous as to program or policy, will intelligently oppose rigorous community restrictions—*p. 550.*

Republicans Introduce St. Lawrence Bill at Albany, Insuring Passage

INTRODUCTION in the New York State Legislature on Wednesday by a member of the Republican majority—Assemblyman J. W. Cornaire of Jefferson County—of a bill to set up a state power authority to generate electricity on the St. Lawrence River seems to insure the passage of this legislation before the session comes to an end. The bill introduced is the one prepared by the Governor's St. Lawrence Power Development Commission and represents the majority views of that commission. It is now thought unlikely that a minority bill providing also for a state transmission system will be introduced, though amendments may be accepted.

Governor Roosevelt has accepted the measure "in principle," but he is expected to suggest several amendments at a conference he is to have with Republican legislative leaders.

The bill provides that the board of trustees forming the power authority shall be composed of five members, who are to receive salaries of not more than $10,000 a year. Newspaper reports say that one of the changes the Governor will suggest will provide that there shall be three full-time members, each to be paid not less than $20,000.

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Plans for Atlantic City Convention of N. E. L. A.

THE PRELIMINARY ARRANGEMENTS for the fifty-fourth annual convention of the National Electric Light Association, to be held at Atlantic City on June 8-12, have been completed. On Monday, June 8, the manufacturers' exhibition (referred to on page 561) will open, finals in the national employee speaking contest will be held in the afternoon, and the president's reception will take place at 9 p.m., followed by dancing. General sessions will be held on the mornings of Tuesday, Wednesday, Thursday and Friday. Sectional sessions will be held in the afternoons—accounting and engineering sessions in parallel Tuesday afternoon, commercial session on Wednesday afternoon, public relations session on Thursday afternoon, and the open session of the public policy committee on Thursday evening.

Arrangements have been completed with the Pennsylvania Railroad to run a special train from Chicago to Atlantic City with special Pullmans from Detroit, St. Louis and Kansas City. All Western delegates are urged to use this train, which will depart from Chicago Sunday, June 7, at 1:15 p.m., Central standard time, and arrive at Atlantic City 9:45 a.m. Monday, Eastern standard time. The Rocky Mountain Division also plans to operate a special train.

▼

Stone & Webster Change Puget Sound Set-up

SEATTLE ADVICES to the ELECTRICAL WORLD say that A. W. Leonard, president of the Puget Sound Power & Light Company since 1914, is about to resign that post to accept the chairmanship of the Engineers' Public Service Company, which, it is stated, has assumed control of the Puget Sound Power & Light. Mr. Leonard, who will remove to New York, will succeed C. W. Kellogg, retiring, and will himself be succeeded at Seattle by J. F. McLaughlin, vice-president of the Eastern Texas Electric Company and the Gulf States Utilities.

A contract under which the Stone & Webster Service Company had operated all the Engineers' Public Service utilities having ended, the parent company will now, it is stated, itself operate its properties.

Niagara Falls Power and Power Board in Accord

FULL ASSENT on the part of the Niagara Falls Power Company to the request of the Federal Power Commission for access to books and documents came as the result of an informal conference held on March 17. Randall J. LeBoeuf, Jr., counsel, and Colonel William Kelly, vice-president, represented the company at the commission's office. The federal license was issued in March, 1921. Under its terms a determination of fair value of the property by the commission is required, but for years the completion of this task has been prevented because access to the books of the company was not granted. This obstacle is now removed, for Mr. LeBoeuf assured the commission that all records and books of both the licensee company and its predecessors would be opened for examination. The attitude of the company now is "to make a full and complete presentation of all facts surrounding the power development and license at the Falls."

Work by the federal engineers and accountants under the plan of procedure agreed upon last Tuesday will begin early in April. This procedure contemplates an early determination of fair value by mutual agreement as provided in the act, and in the failure of such agreement will give to the commission opportunity for determination by the court as provided by law.

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LARGEST GOVERNMENT CONTRACT IS SIGNED

—*Wide World Photos*

Representative P. D. Swing of California (left), sponsor for the Boulder Dam bill in the House, and Dr. Elwood Mead, Commissioner of Reclamation, watch Secretary Wilbur sign contract for work worth $48,890,995 on dam, tunnels and power house.

Supreme Court Hears Arizona's Suit Over Dam

HEARINGS WERE CLOSED last week before the United States Supreme Court in the injunction suit brought by Arizona to restrain the other Colorado River Basin states and the Secretary of the Interior from carrying out the Hoover Dam project. Since both sides were permitted to present their arguments, it does not seem probable that the case will be thrown out of court without further consideration of the evidence that was presented.

Those familiar with court procedure believe a decision will not be rendered until after April 13, which is the date that the court will meet again following a two weeks' recess, although it is quite possible that the decision may be deferred until next fall or, on the other hand, it may be handed down on March 23, before the recess begins.

▼

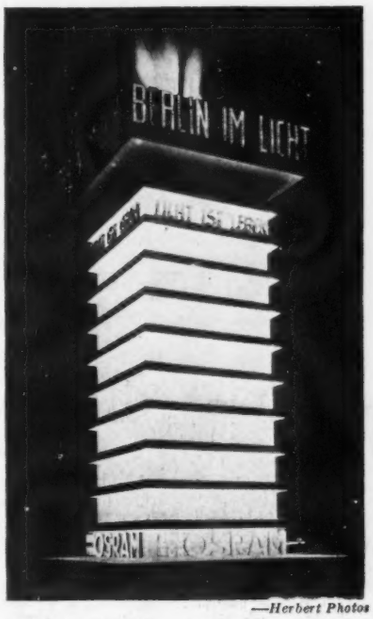
Seattle Council Backs Ross by Eight to One

EXPRESSING ITS CONFIDENCE in J. D. Ross, former head of the municipal lighting department, and declaring charges brought against him by Mayor Frank Edwards and reported in these columns last week (page 478) to be groundless, the Seattle City Council on Monday, by a vote of eight to one, adopted a resolution requesting the Mayor to withdraw his nomination of Armand F. Marion as head of the department. The Council informed the Mayor that "under the existing circumstances" it will confirm no one but Ross for the position.

In retaliation for the Mayor's action in summarily dismissing Superintendent Ross, the Citizens' Municipal Protective League demanded the impeachment of Mr. Edwards by the Council, charging the Mayor on eleven counts with violation of his oath of office, and those charges were referred to a committee for formal consideration. They included alleged violation of oath of office in the appointment of City Engineer R. H. Thomsen, Superintendent of Public Utilities George B. Avery and Superintendent of Water William Severyns.

The Council's expression of confidence in Mr. Ross was voted after the Mayor's written charges had been read and Ross had replied both orally and in a long written statement. Unless the Mayor reinstates Mr. Ross or the Council rescinds its action, the lighting department for the next fifteen months will operate under the direction of Glen Smith, who has been the assistant superintendent.

BERLIN LIGHT TOWER



—Herbert Photos

"Light is life" proclaims this futuristic sign in the German capital to residents and visitors

▼

Harriman Justifies Early New England Financing

CONSERVATISM OF New England banking houses, legal obstacles, the undeveloped state of electrical transmission —then in its infancy—and the then prevailing competitive conditions were advanced by H. I. Harriman, vice-chairman of the New England Power Association, in testimony given by him on March 17 in the Federal Trade Commission's inquiry into the practices of that association, as a justification for the financing of a speculative character that was resorted to in early days by some of the constituent companies of the Power Association.

Mr. Harriman pointed out that financing for construction purposes could not be done on a conservative basis owing to the lack of a market for such securities, so that resort to the sale of bonds at discount together with a stock bonus became necessary; that the right of eminent domain did not exist for the acquisition of land for transmission lines, necessitating in many cases the payment of exorbitant prices, and that legal restriction in Massachusetts of operating companies to the towns served by them forced the formation of holding companies for general control purposes.

"Back in 1910 the Connecticut River Power Company of New Hampshire and the New England Power Company were not public utilities," Mr. Harriman said. "They had no assured market. They were speculative, and they had to be financed as any other industry with those characteristics was financed. I have no apologies to make or regrets for any of the financial methods used in the early days of the company. They have been fully justified by the results and by the fact that the New England Power system has brought an almost inexhaustible supply of low-cost and dependable electricity to the homes and to the manufacturing industries of New England."

▼

Power and Regulation in State Legislatures

ALABAMA. — The resolution providing for an investigation into power-company activities has been approved by Governor Miller. The investigation is to be undertaken during the long session of the Legislature, which begins March 31. A bill introduced in the Senate would relieve public utility customers from payment of collection fees on delinquent accounts or of charges imposed for the restoration of discontinued service.

ARKANSAS.—Before the Legislature adjourned the Senate, without a dissenting vote, postponed indefinitely the House bill to tax electric, gas, telephone and telegraph company receipts to retire school-bond indebtedness. This action defeated the measure, which had passed the House by a margin of one vote.

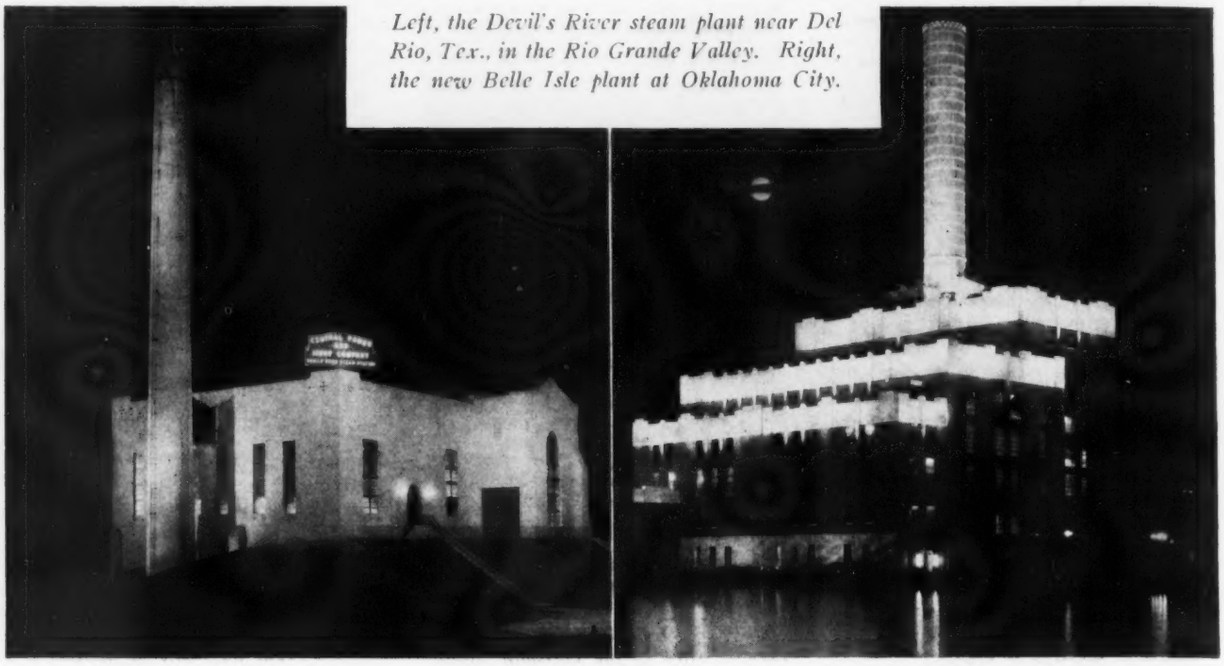
CALIFORNIA.—A bill has been introduced to set up a Department of Radio Supervision under the direction of the Railroad Commission. It would tax every radio set 50 cents. Another bill prohibits expenditure by public utility corporations for alleged political purposes.

IDAHO.—A measure imposing a tax of 0.5 mill per kilowatt-hour on all electrical energy generated in the state will be levied by a bill that has passed the Legislature. It will affect chiefly three large Western light and power companies.

ILLINOIS.—A bill has been offered to repeal the act which authorizes cities and villages to operate waterworks and other public utilities.

IOWA.—A Senate commission proposal to amend the House bill to permit municipalities to purchase public utilities out of future earnings by providing for submission to popular vote of the contract for the purchase of the plant or equipment was called a "joker" by advocates of the bill, which provides for the submission of the proposal to purchase a plant or equipment and a public hearing upon the contract submitted.

SOUTHWESTERN ENTERPRISE "RIGHT THERE" WITH PLANT FLOODLIGHTING



Left, the Devil's River steam plant near Del Rio, Tex., in the Rio Grande Valley. Right, the new Belle Isle plant at Oklahoma City.

▼ ▼ ▼

The original bill carried by 37 to 13 and went to the Governor. The Senate also passed a House bill for the assessment of all public utilities by the State Board of Assessment and Review. The House rejected by 74 to 28 a bill to authorize diversion of the Cedar River at Moscow into the Mississippi to permit construction of a hydro plant on which $10,000,000 was to be spent in two years. The Senate had passed the bill with 27 majority.

KANSAS.—Both houses have passed a law requiring utility holding companies that charge "engineering and management" fees to their operating subsidiaries to submit to investigation and regulation by the Public Service Commission, and it awaits the Governor's action. The House appropriated $50,000 a year for two years for expenses of investigation. The alleged natural-gas monopoly of the Doherty interests is the chief target of the legislators.

MISSOURI.—A Senate committee has killed bills on the lines of the one just passed in Kansas which would have empowered the Public Service Commission to look into the books of holding companies and have compelled such companies to furnish lists of stockholders and other information with a bearing on rate making. As in Kansas, the legislation was prompted by opposition to Doherty gas companies. The Maxey bill to prohibit merchandising by utility companies has passed the House. It was vigorously supported before a Senate committee by representatives of hardware and furniture dealers' associations, while its constitutionality was attacked by a former Supreme Court judge.

MASSACHUSETTS. — Legislation which would place the entire expenses of administering the Public Utilities Department upon the state was urged last week before the legislative committee on state administration by Representative Edward J. Kelley of Worcester. Under existing statutes gas and electric light companies in the state are compelled to contribute to the expenses of the commission.

NEBRASKA.—The House, by 50 to 36, indefinitely postponed a bill sponsored, it is reported, by the Nebraska Hardware Dealers' Association that would have forbidden public utilities to continue to sell merchandise at retail. The Senate advanced to third reading without opposition a bill empowering irrigation districts to acquire or construct power plants, when authorized by the electors on a 25 per cent petition calling for submission of the proposal, and to issue bonds, levy a tax or pledge future net earnings to finance the project. The bill also carries permission to purchase energy from government irrigation dam projects.

NEW YORK.—The nine utility bills sponsored by the Governor and alluded to last week follow in general the recommendations made last year by the minority members of the legislative commission which inquired into the public service law. Several of them are merely alternative measures to be introduced if the preferred ones do not pass. Whether the bills will be pressed so near the end of the session remains to be seen. A bill signed by the Governor to permit corporations to contribute to charity and unemployment funds specifically excludes public utility corporations from its provisions on the ground that to permit their directors to vote stockholders' funds for such purposes would open the door to possible efforts to sway public sentiment to the advantage of the utilities.

NORTH CAROLINA.—The House finance committee has voted, 14 to 3, to impose a 5 per cent consumers' tax on electricity, gas, telephone and telegraph service and to levy additional franchise taxes on all corporations. The franchise tax on power companies would be increased from 2 to 4 per cent on gross receipts.

OKLAHOMA. — Both Senate and House have now passed the bill prohibiting public service corporations from selling merchandise not directly connected with their general business, and it has gone to Governor Murray, who had advocated such legislation. A bill requiring light and power companies to maintain uniform schedules for electricity where more than one town is served has been reported favorably by the House committee. Another measure providing that the value of property of public service corporations for rate-making purposes shall be fixed as the value by the State Board of Equalization for the purpose of taxation was advance to third reading in the lower house.

OREGON. — Governor Meier has vetoed a bill dealing with the Klamath River which was desired by the California-Oregon Power Company to facilitate an extensive development by it on that stream. The Governor holds that application should be made to the Oregon Hydro-Electric Commission, a new body provided for by the Legislature before its adjournment.

PENNSYLVANIA.—Representative Frederick Beyer of Philadelphia has introduced a bill abolishing the present Public Service Commission and creating a Fair Rate and Public Service Commission to consist of seven members and the Governor ex officio. The members are to be selected from a list of eligibles compiled by judges, two to be finally chosen by the Governor, two by the Lieutenant Governor, two by the Speaker of the House and one by the Supreme Court. There is also to be a citizens' solicitor. Earnings of 52 light and power companies have been compiled by an accountant for the information of the House investigating committee. More than half of the respective sums show a return exceeding 7 per cent. To the rival Senate investigators Senator Woodward of Philadelphia has sent a letter denouncing Commissioner James S. Benn and declaring that his nomination for a new term (made by former Governor Fisher) should be rejected by the Senate.

TENNESSEE.—A levy of 0.25 mill per kilowatt-hour on electric power produced in the state has been voted by the ways and means committee as part of the general revenue bill to be recommended to the General Assembly. Officials of the Railroad and Public Utilities Commission estimated that the tax would produce about $350,000 annually.

TEXAS.—Extending his official approval to the bill for utility regulation prepared by the City Attorneys' Association of Texas, Governor Sterling said in a special message: "In my opinion there is no subject of legislation now pending before the Legislature which is of greater importance than that providing for efficient utility regulation. The tremendous amount of business, the extensiveness of operation, the necessity of their service, the protecting of the rights of the people require the establishment of an independent and well-financed commission in order that effective regulation may be truly accomplished. Additional bureaus and commissions as a matter of course should not be established except in case of extreme public necessity. The utility situation presents such a case and makes the investment one of immediate necessity. The commissioners must be men of business experience."

WEST VIRGINIA.—The Hodges-Watkins bill amending the water-power act (ELECTRICAL WORLD, March 7, page 437) failed to pass the Senate before the end of the regular session on March 14. A special session on the budget is now being held by call of the Governor.

WISCONSIN.—Strong opposition in the Senate was encountered by the Loomis district power bill, which provides for the establishment of power districts governed by five directors appointed by the executives of the municipalities voting to form a district, with power to levy new taxes on real estate and personal property. The bill, however, passed on Wednesday, March 18, by eighteen to fifteen. Senator G. W. Blanchard, opposing the taxing provision, said: "The theory of the advocates of this program is that in twenty years or so the original investment will be wiped out and from then on there will be no capital charges. They overlook the fact that on the average the plant and distribution system is outgrown, worn out or obsolete within twelve or fifteen years after its construction, so the amortization plan will be lagging by a full five or eight year."

▼

Eastern Engineers Favor Medium-Voltage Networks

MEDIUM-VOLTAGE NETWORK distribution systems for medium- and heavy-load districts and for metropolitan office buildings were given much impetus by a whole day of discussion at the Middle Eastern District A.I.E.E. meeting in Pittsburgh last week. Philadelphia and Pittsburgh have had encouraging experiences with networks from the standpoint of both economics and operating characteristics. A system of high-voltage cable distribution in tall office buildings is being evolved to standardized practice in New York City.

As for transmission, it was established that ungrounded operation is passing and the use of neutral reactance is increasing. A much larger percentage of higher-voltage lines are solidly grounded than in the case of low voltage. There is some concern over the likelihood that system insulation may have to be increased to meet the potential values resulting from neutral impedance.

The Engineers' Society of Western Pennsylvania and the Association of Iron and Steel Electrical Engineers joined the A.I.E.E. in these meetings. The latter organization sponsored sev-

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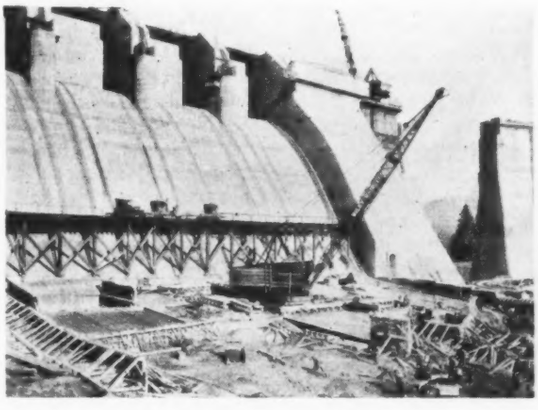
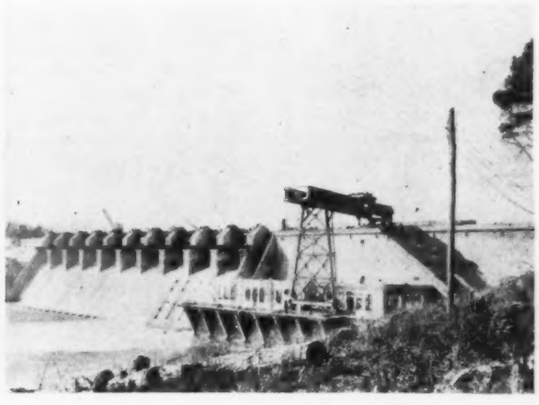
TWO MORE LARGE WATER-POWER DEVELOPMENTS ALMOST READY





On the left is the latest view of the Ariel Dam of the Inland Power & Light Company of Portland, Ore. This project, on the Lewis River in southwestern Washington, is the first seasonal-storage plant in its territory. With a 185-ft. head, the plant is designed for four units, of which one (45,000 kw.) will be ready next fall. On the right is a recent view of the Arkansas Power & Light Company's Carpenter Dam and power house, on the Ouachita. This development will have an initial capacity of about 75,000 hp.

eral papers on steel-mill electrification which indicated a marked advance in the mutual relations of utilities and industrial firms in interchanging power. The obscure factors which once were obstacles to joint arrangements have now become the basis of distinct economies to both participants. W. P. Skinkle of the Carnegie Steel Company called attention in the discussion to actual rates as high as $1.15 per kilowatt-hour for small amounts of power taken for short intervals at inordinate peaks which fix the monthly demand charge. Controlled demand is advocated by industrials and should be favored by utilities, he maintained.

▼

Bremo Bluff (Va.) Plant May Start This Month

WITH AN INITIAL RATING of 30,000 kw., in two units, the steam-electric plant of the Virginia Public Service Company at Bremo Bluff, Va., is expected to go into operation this month. Its ultimate capacity will be 200,000 kw. The Bremo Bluff plant is intended to be the base-load station of the entire Virginia Public Service system, which extends from Alexandria west to Hinton, W. Va., and south to South Boston, Va., and thence east to Emporia. Pulverized coal will be burned. The station is connected to the transmission system of the company over duplicate 66-kv. lines to Charlottesville. The plant is constructed of brick and reinforced concrete.

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Boston Edison's Off-Peak Water-Heating Rate

THE BOSTON EDISON COMPANY has filed a two-part off-peak rate for domestic and commercial water heating, effective April 1, as follows: Demand charge, $12 per year per kilowatt of capacity connected in excess of 5 kw., payable monthly; energy charge, 3 cents per kilowatt-hour for the first 25 kw.-hr. per month and 1 cent for the excess; minimum charge, $9 per year.

The new rate applies to storage-type tanks of at least 30 gal. capacity where conditions permit supplying such water-heating load off-peak without additional distribution investment by the company. No service will be supplied during the restricted periods, which include the hours from 3 p.m. to 10 p.m. daily during the months of October to April inclusive. The company reserves the right further to restrict the hours of service, depending upon conditions affecting available spare capacity.

Conquering a Storm in Central Vermont

NORMAL SERVICE WAS RESTORED to the customers of the Central Vermont Public Service Company in the Rutland area last week with remarkable speed after the heavy snowstorm of March 8 (ELECTRICAL WORLD, March 14, page 479), thanks to the co-operation of utility interests and well-tried organization of maintenance forces. At about 6 p.m. heavy, wet snow began to fall on the western side of the Green Mountains, with gales up to 60 miles an hour. Many trees in and about Rutland were uprooted, causing damage to the distribution system, and two hours after the storm arrived about 2,000 customers in the city were without service. In a period ranging from two hours to day-

What happened to one pole

light, service was restored to half of these customers, and it was completed to the remainder within 24 hours from the start of the storm. The company lost only about a dozen poles in Rutland, the chief trouble being from wires broken by falling trees.

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Rate Adjustments in Three Ohio Communities

THE CITY COUNCIL OF TOLEDO has passed an ordinance reducing the electric light bills of approximately 55,000 consumers. For the average consumer the ordinance will, it is said, effect a saving of 30 to 90 cents a month. The ordinance, which will become effective April 1, will be operative for five years and may not be repealed sooner.

The City Council of Lorain has passed a measure changing the electric rate to domestic consumers of that city to 4½ cents a kilowatt-hour for 30 kw.-hr., plus a service charge of $1. The rate then drops to 3 cents for 170 kw.-hr. and then 2 cents. Officials of the Ohio Public Service Company announced that the new rates will mean a saving of 15 per cent to the consumer.

A five-year franchise for supplying Xenia with electric light and power has just been granted to the Dayton Power & Light Company by the Xenia City Commission, with the right reserved to terminate the service at the end of the first year if not satisfactory. Present rates are retained. The Fairbanks-Morse Company sought a franchise through an organization known as the Citizens' Public Service Corporation, which proposed to construct a power house and build the necessary distributing lines.

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Load Building and Lighting Are Illinois Topics

"LOAD BUILDING AHEAD OF US" was the subject of an address by Oliver R. Hogue, Commonwealth Edison Company, Chicago, who as retiring president conducted the annual meeting of the Illinois State Electric Association, held in Springfield on March 12 and 13. Charles W. Hadley, chairman Illinois Commerce Commission, was among the speakers at the joint session of the electric, gas and railway associations which opened the two-day convention.

R. J. Malcomson, Public Service Company of Northern Illinois, speaking on "Home Lighting—a Challenge," declared that if one empty socket in each domestic customer's home can be made a producing socket with a 40-watt lamp, if one 40-watt lamp be replaced by a 60-watt, and if one 60-watt bulb can be added by the introduction of a portable lamp, this will represent $173,700,000 of additional revenue each year.

In a symposium on lighting, H. A. Cook, Detroit Edison Company, maintained that while power installations are in general constant in capacity, lighting affords a variable and hence an opportunity for additional revenue. G. E. Korten, Consumers Power Company, discussed "Outdoor Lighting." A. A. Togesen, Illinois Power & Light Corporation, declared that electrical advertising offers the most lucrative field in the electrical industry today.

A. D. Mackie, general manager Illinois Power Company, Springfield, was elected president of the electric association; Adam Gschwindt, vice-president Rockford Electric Company, vice-president, and George W. Schwaner, Springfield, re-elected secretary-treasurer.

Scattered Happenings in the Electrical Sphere

United States

LEASING OF THE Norway and Oakdale hydro-electric generating plants on the Tippecanoe River and the transmission facilities of the Indiana Hydro-Electric Power Company to the Northern Indiana Public Service Company and operation of these properties as an integral part of the latter company's system are proposed in a petition filed with the Public Service Commission of Indiana. Both utilities are Midland United Company properties, controlled by the Insull interests.

ERECTED AT A COST OF $1,000,000, a new West Side transmission line from the Lakeside plant and a new 90,000-kw. remotely operated substation on Twenty-eighth Street have gone into permanent operation in Milwaukee. They will serve the downtown commercial and Menomonee Valley industrial districts, together with a portion of the West Side residential district.

CHARLES A. RUSSELL, whose removal by the Federal Power Commission from the post of solicitor caused a political controversy not yet settled, has been retained by the State of New York to make legal and physical surveys of the water of the Barge Canal and of river-regulating works in places where power generation is involved.

ORDERS FOR 4,000 TONS of structural steel for transmission-line tower construction were placed March 10 by the Southern California Edison Company for use in construction of 15 miles of 220-kv. line between the Lighthipe substation and the projected Stanton substation and another 15 miles of sub-transmission line into and out of the latter station, which will have a capacity of 150,000 kva. and be finished next year.

MANY UTILITY WOMEN as well as some male executives and engineers will participate in the second national home service conference at the Edgewater Beach Hotel, Chicago, next week from Monday to Thursday inclusive. The conference is under N.E.L.A. auspices, the American Gas Association co-operating.

CONSTRUCTION OF THE Cardiff substation, to have 40,000 kva. capacity, has been begun at San Bernardino, Calif., by the Southern California Edison Company. It will serve a large residential section.

A REPORT ISSUED by the Federal Power Commission on the potential storage resources of the South and Middle Forks of Kings River, Calif., estimates them at about 400,000 acre-ft. This would make possible, the report indicates, about 800,000 electrical horsepower and the annual production of 3,600,000,000 kw.-hr. of primary and an indeterminate amount of secondary energy.

REPORTS ON THE ONTARIO hydro-electric system and the Cleveland municipal plant have been published by the Utilities Publication Company, Chicago, the former showing total receipts in 1929 to have been $14,518,850 less than total expenses and fixed charges; the latter, by Howell Wright, who managed the Cleveland plant from 1924 to 1930, showing a loss of more than $4,000,000 in fifteen years.

SEVENTY-FOUR MICHIGAN communities —60 in the lower peninsula and 14 in the upper—which previously had no central-station electric power service were connected with the lines of the state's power systems during 1930, according to a survey just completed by the Utilities Information Bureau of that state.

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Coming Meetings

Southeastern Division, N.E.L.A.—Vinoy Park Hotel, St. Petersburg, Fla., April 1-3. C. M. Kilian, 508 Haas-Howell Bldg., Atlanta, Ga.

Arizona Utilities Association—Biltmore Hotel, Phoenix, April 8-11. J. S. Arnold, 300 West Washington St., Phoenix.

Great Lakes Division, N.E.L.A.—Engineering Section, Chicago, April 9-11. L. F. Hickernell, Consumers Power Bldg., Jackson, Mich.

Maryland Utilities Association—Lord Baltimore Hotel, Baltimore, April 10. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

Northwest Electric Light and Power Association—Accounting Section, Salt Lake City, April 13 and 14; general convention, Boise, Idaho, June 17-20. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 16-18. F. D. Beardslee, 315 N. 12th St., St. Louis.

Southwestern Division, N.E.L.A.—Mineral Wells, Tex., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Electrochemical Society — Hotel Tutwiler, Birmingham, Ala., April 23-25. C. G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—District meeting, Rochester, April 29-May 2. F. L. Hutchinson, 33 W. 39th St., New York.

East Central Division, N.E.L.A. — Deshler-Wallick Hotel, Columbus, Ohio. May 11-13. D. L. Gaskill, 603 Broadway, Greenville, Ohio.

National Electrical Manufacturers' Association — Hot Springs, Va., May 18-23. A. W. Berresford, 420 Lexington Ave., New York.

Middle West Division and Nebraska Division, N.E.L.A.—Excelsior Springs, Mo., May 20-22. Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

National Electrical Credit Association—Hotel Pennsylvania, New York, May 21 and 22. F. P. Vose, 1008 Marquette Bldg., Chicago.

National Electrical Wholesalers' Association—Hot Springs, Va., May 27-30. E. Donald Tolles, 165 Broadway, New York.

Wisconsin Utilities Association — Accounting Section, Racine, May 28-29. J. N. Cadby, 135 W. Wells St., Milwaukee.

National Electric Light Association—Atlantic City, June 8-12. A. J. Marshall, 420 Lexington Ave., New York.

THE CITY COMMISSION of Piqua, Ohio, has adopted an ordinance providing for an electric light survey in that city to determine the advisability of establishing a municipal plant. Piqua is now served by the Dayton Power & Light Company.

POWER RATES for the Old Dominion Power Company, which operates in southwestern Virginia, providing, among other changes, a reduction of 1 cent a kilowatt-hour in the first bracket, have been approved by the Virginia State Corporation Commission.

WORK WILL SOON BE STARTED by the California-Oregon Power Company on the construction of a regulating dam at Keno, Ore., on the Klamath River. It will be 8 ft. high and approximately 1,200 ft. long.

CONSTRUCTION OF A SEVEN-STORY office building with tower, a three-story service station and warehouse and a three-story garage by the Syracuse (N. Y.) Lighting Company is scheduled to begin by May 1.

ATTORNEY-GENERAL PETERSON of Arizona, President Jones and Managing Director Clapp of the N.E.L.A. and other well-known men will be "headliners" at the convention of the Arizona Utilities Association in Phoenix on April 8-11. It will be held jointly with the Pacific Coast Electrical Association.

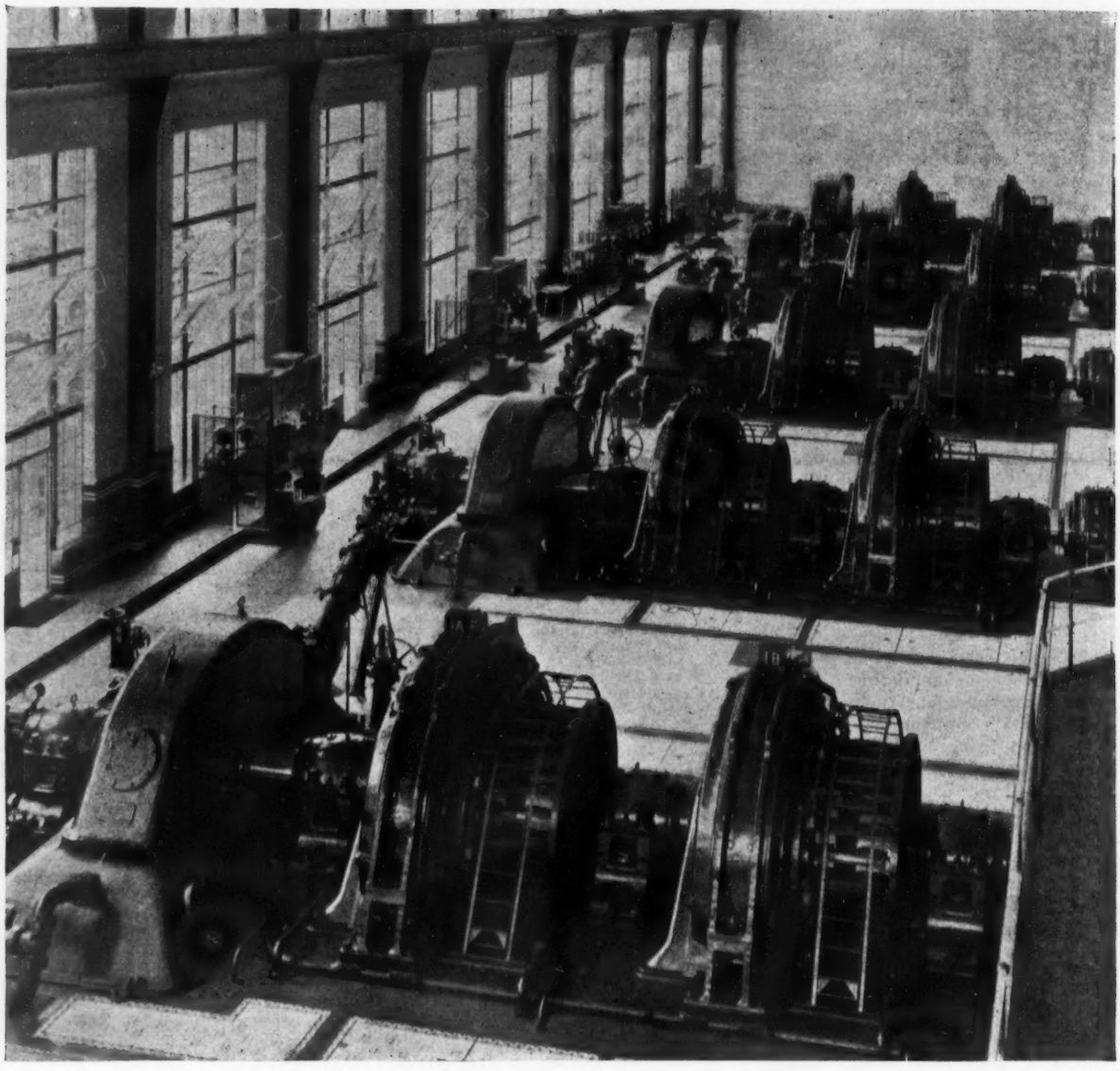
Canada

MONTREAL HAS ABANDONED the plan to have the city aqueduct serve as a source of power for electric lighting of streets. The former administration paid $80,000 for a plot of land west of the city which was to serve as a site for the station. Engineers, however, reported that the city would not profit by having its own power station as frazil ice in winter would interfere with operation of the turbines. The present executive will recommend that the city renew its contract with the Montreal Light, Heat & Power Consolidated for a long term, probably 25 years.

Abroad

PARIS WILL AGAIN BE the meeting place of the International Conference on Large Electric High-Tension Systems this summer, from June 18 to 27. This will be the sixth biennial meeting. M. Tribot Laspierre, 54 Avenue Marceau, Paris, is the secretary.

AN INTERNATIONAL BANKING group, including Harris, Forbes & Company, the Chase Securities Corporation, the J. Henry Schroder Banking Corporation, Otis & Company and the United Light & Power Company as American participants, has, cable reports say, submitted to the municipal authorities of Berlin a plan to acquire the Berlin City Electric Company.



English Electric Co., Ltd.

51,000 hp. for British electro-metallurgical works

At the Lochaber station of the British Aluminium Company, Ltd., said to be the largest hydro-electric undertaking in Great Britain, there are five 9,600-hp. direct-current machines operating at 10,000 amp. constant current, 150-340 volts variable potential, and driven by Pelton waterwheels. A variable head of 650 to 800 ft., with average of 720, is utilized. Two auxiliary 1,500-hp. alternators complete the present installation. A 15-mile tunnel, 15 ft. in diameter, driven through solid rock brings water to the plant.

EDITORIALS

L.W.W.MORROW
Editor

Good will of big investors a priceless asset

TO HAVE a ready market for its securities when capital is needed is a valuable asset to any utility. When such a market, in the form of large institutional investors, actively solicits the securities of a particular company, the situation is not only of actual monetary value in reducing selling costs, but a singular compliment to management as well. This, Chairman John B. Miller of the Southern California Edison Company, Ltd., states in the company's annual report, has been the experience of his company.

The large capital-investing interests in the nation's money markets, especially institutional investors, employ rigid rules and measuring rods. They lay their yardsticks alongside management, credit standing, earnings record and capital structure as well as the more tangible property values. Their requirements, like those of the investment banking group, are highly exacting.

All this emphasizes how imperative is scrupulous integrity on the part of those dependent upon public funds—how essential is a square deal to the investor. Most utilities have clean records in this respect. There have been few violations of public trust, and it is to be hoped that such a situation will continue. Utility securities are in general favor at the moment, and legislation governing their purchase by fiduciary and other institutions is being liberalized. How important this market will become depends on the utilities individually and collectively.

But, in addition to mere integrity in the setting up of securities for sale, the Southern California Edison experience calls attention to the potential value of building up similarly attractive credit standing. It suggests a thorough study, followed by action, of the various governmental and institutional requirements — even the whims and preferences—of these large investors, who constitute an increasingly important market for utility securities. For beyond the actual savings resulting from direct purchase by institutions nothing could do more to create confidence in the minds of the millions of small investors who buy securities.

Air pollution from powdered-fuel plants

POWER utilities in this country having pulverized-fuel-burning stations in or near cities are not alone in being attacked for polluting the atmosphere, as John B. Kershaw of London brings out in his excellent contribution on the subject in this issue. Apparently health authorities and other civic officials in England and Germany, as in this country, have overlooked the fact that power utilities, including street railways, burn only 8 per cent of the total coal consumed and that, because of their self-interest in economical combustion, they do so with much less pollution of the atmosphere than that caused by householders, by commercial and industrial plants, by steam railroads and even by automobiles.

Despite the minor nature of their contribution to air pollution, several power utilities in this country have for years been studying and applying methods of minimizing this pollution, and these and others will continue to do so if they recognize the business asset of public good will. Not only have they experimented with centrifugal-type cinder catchers, gas washers and electric precipitations, but they, as well as furnace manufacturers, have been moderately successful, through more scientific combustion, in reducing the volume of suspended matter which is discharged to the

stack. Nevertheless, power companies here are likely to be interested in the types of cinder catchers and gas washers used abroad, in the effectiveness of methods employed and in the capital investment and unit operating costs reported by Mr. Kershaw. The ability of European engineers to remove from 95 to 97 per cent of the suspended matter and sulphur acids is highly commendable, but when it is considered that the St. Pancras gas-washing installation increases the cost about $25,000 to burn 2.7 tons of coal per hour, that the Battersea installation requires 25 tons of scrubbing water per ton of coal burned, and that the capital and operating expense has been increased 36 cents per ton of coal burned, it seems evident that great strides still have to be made before prevention of air pollution will be economical, unless the public is willing to carry the additional burden that it would impose.

While searching for the economical solution considerable reduction in the pollution of air could be effected if all household, commercial and industrial heating requirements for steam, hot water or power were provided by utility plants and if steam railroads in the vicinity of cities were more extensively electrified.

The engine-mindedness of the oil industry

VIRTUALLY every industry that uses machines has passed through the engine-minded stage of thought early or late in its history. Some are not yet out of it, notably two of the most important. These are railroads and oil. In both cases long acquaintance and experience with flywheels and pistons sometimes is a bar against even the consideration of power in any other form. Particularly is this observation justified right now by the frequently futile efforts of electric utilities to sell electricity for pipe-line pumping.

Is the petroleum industry unintelligent? Certainly the answer cannot be "yes" if one considers the really amazing progress that has been made of late years in the processes of refining and the daring business sense that lays pipe lines up and down and across the nation. There are many good business executives and good engineers in oil. But there are also enough of the other kind to justify asking the above question, if not an affirmative reply to it.

Otherwise how can it be explained why when a power salesman finally penetrates into the presence of some executives of pipe-line companies he is told before he opens his mouth that there is no chance of electricity being used for pumping, that as a matter of fact engines have already been ordered for the job and that he had better move along and not waste valuable time? The engine-minded executive has made up his engine-minded mind. To the extent that he permits his prejudices to close his thinking against even the consideration of electric power that executive lowers the collective intelligence quotient of the petroleum industry.

Local responsibility for legislation against merchandising

IN nine state legislatures at least bills have this year been introduced to prohibit utility companies from merchandising domestic appliances. Such legislation is in the political wind. Though the bills in most of these states seem unlikely to become law, it is none the less a matter that intimately concerns all utility companies.

Such legislation, while local to a state, is national in its import and effect because the idea spreads with the news. But the cure for it throughout the industry and in the national sense waits upon the action of utilities not in the states but in communities. For it is in the individual city that bad trade relations start.

Much of the present opposition to the sale of household appliances by electric power companies is the direct outgrowth of local conflict over merchandising practices between the power companies and the dealers—hardware, department store and electric. Dealers have complained in meetings of their national associations. The word has passed around that something ought to be done about it. As a result dealers in other towns have become concerned over the principles involved and talked to their legislators, and trouble has broken out at

points far distant from the place of original agitation.

The National Electric Light Association is now taking the proper national action in co-operating with the National Hardware Dealers' Association and the National Dry Goods Association through the recently organized joint committee on electrical merchandising. This committee will make a thorough survey of the causes of friction between the dealers and the utilities, inquiring into what policies are wrong and what are right. But all this takes time. Meanwhile there is local work to be done by individual power companies wherever trade relations are not right. This means wherever it has not been recently proved that they are right, for there are too many cases where policies are assumed to be all-satisfactory because no formal protest has been made. Such practices are causing active discontent and bringing retaliation aimed through legislation against the entire industry.

There is a responsibility here that rests upon each power company. It should be recognized in every city.

Need urban lines be designed for open-country stresses?

IN SOME localities and to some extent the weather shielding afforded by buildings receives consideration in the design of lines to be erected in urban territory; but this factor is not taken so widely into account as perhaps might be possible if data were available to prove that city lines are not in general as much subject to stresses caused by weather as are lines in open country. Certainly a pole line in a city alley sheltered on both sides by buildings will never have to resist such wind strains as would be present if the buildings were not there. Then why should this alley line be designed for extreme conditions that will hardly ever be imposed on it?

Of late much attention has been directed by political critics to the disproportionate progress made in cost reduction as between generation on the one hand and distribution on the other. In the first field spectacular achievements in increased economy are proudly exhibited. The same searchingly critical analysis of practices and designs that has worked so effectively in generation must be applied to distribution.

The economics of inspection

INSPECTION and test schedules are a sizable component of the charges against maintenance of plant equipment. Economy programs can hardly ignore the opportunity to save at this point. The pleasing aspect is that a less frequent schedule of checks need not be made arbitrarily—there are several grounds for believing that present frequency is often based on conditions no longer extant.

Some inspection schedules date back to the period following the war. Under the pressure of production much of the maintenance was deferred to a less hectic future. When that time came an accelerated inspection compensated for decelerated maintenance. Equipment failures were still frequent, too frequent to accord with the rising stardards in the maintenance of continuous service and the prevention of accidents. The frequency of the checks that were instituted in those days may be unwarranted in the light of the security which these checks have helped to induce.

Then, again, much new apparatus with better durability and certainty of performance has replaced obsolete types which justified the more frequent examination. It has been applied more intelligently and more effectively co-ordinated with its associated equipment. Moreover, new relaying and other protective elements afford more adequate guard against internal and external sources of injury. Even the forms devised to record the fact and the results of inspection may be an unnoticed factor in perpetuating unnecessarily short intervals between observations and tests.

Inspection costs are weighed against the expenditures they can forestall by disclosing incipient breakdown and destructive exposures. There should be no disposition to reduce outlay for inspection below such a balanced value. It is likely, however, that many reductions can be made now by realizing on the other factors which have insured improved performance of systems and apparatus.

Automatic Hydro Plant E

Proved by E

By J. M. GAYLORD

Superintendent Hydro Generation
Southern California Edison Company, Ltd., Los Angeles, Calif.

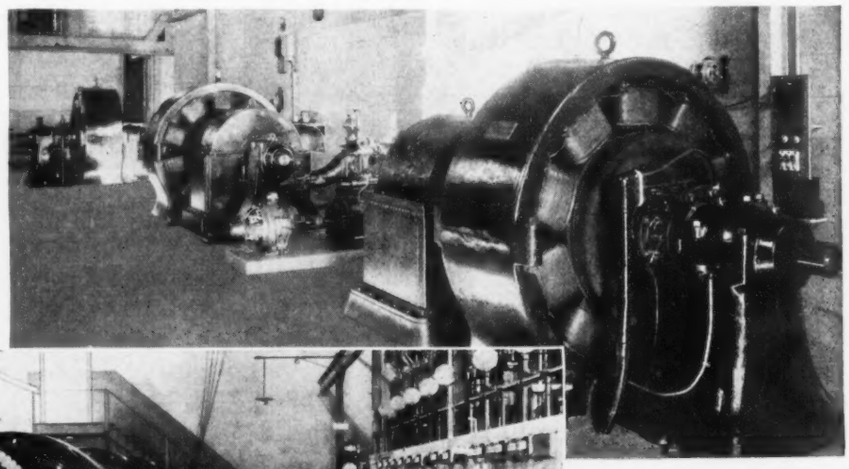
Reduced labor cost and housing expense 57 per cent, and turnover 66 per cent.

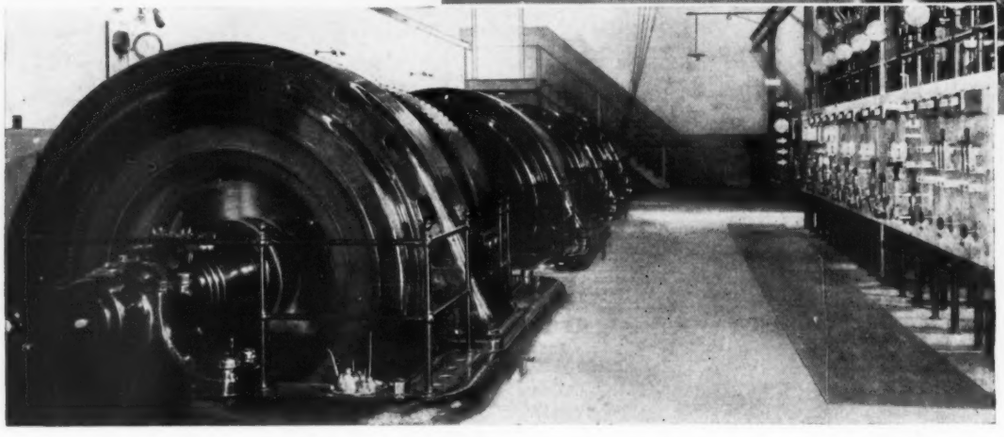
Plants pay for selves in 5½ years.

A PROGRAM of rehabilitation of the smaller hydroelectric plants, which has resulted in seventeen of these plants being made automatic or semi-automatic, has been carried on by the Southern California Edison Company, Ltd., since 1919. Included are 42 units with an aggregate capacity of 48,150 kva. In comparison with the large modern generating station the cost of power produced at small manually operated plants is high and all possible economies must be introduced if the operation of the small plant is to be continued. A change to automatic operation will save operating expense, but automatic equipment represents a considerable new investment which must be justified if the change is to be approved.

Eleven years' experience in the operation of semi-automatic and fully automatic plants on the Edison system has demonstrated very definite savings in operating labor, as will be seen from the accompanying tables. Under manual operation the seventeen plants required 77 operators while with automatic operation 33 operators are employed, a saving of 57 per cent. At the average wage of approximately $1,500 per year, the reduction of 44 men represents an annual saving of $66,000. To this must be added the saving in cost of housing, which cannot be determined exactly, but may be estimated at $20 per month per man, or a total of $10,560 per year.

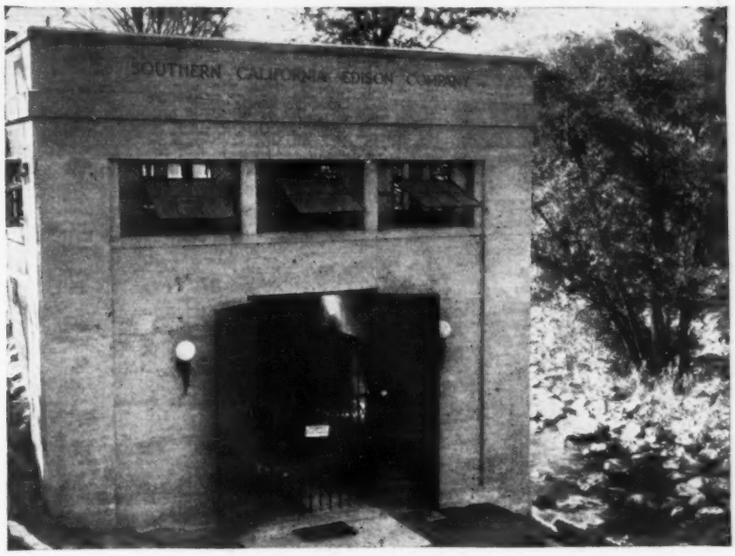
Reduction in operating force reduces overhead as well as direct expense. There is less clerical work, less supervision, less medical attention and fewer personnel troubles. The operators are glad to be relieved of the monotony of watching the equipment, and with little to do in this respect the reduced force finds sufficient occupation in the care and maintenance of the plants and grounds. Under these conditions the operators are happier and the petty jealousies of the small camp are avoided to a large extent. The value of these advantages is hard to estimate, but the labor turnover for the first eleven months of 1930 is an indication of satisfactory labor conditions, particularly at semi-automatic plants. The turnover for the automatic plants was 7½





Two old plants made semi-automatic

Economy Experience



One of the later-type automatic plants

per cent as compared with 22 per cent at the manually operated hydro plants.

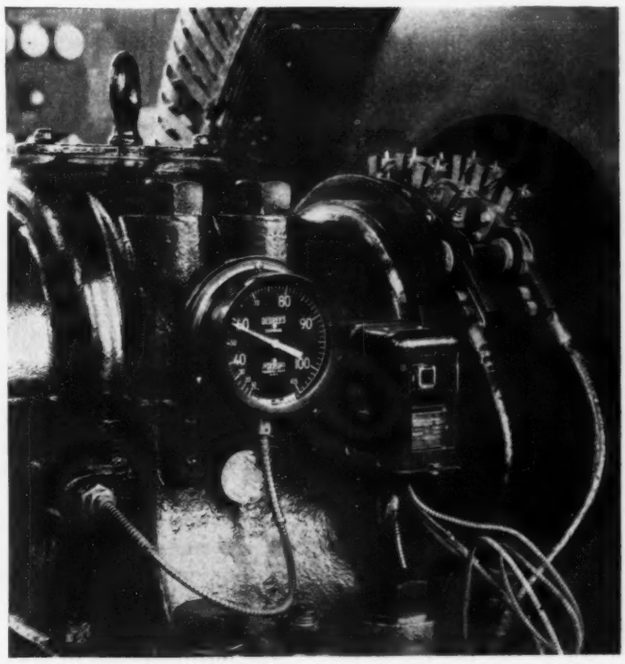
It is much more difficult to determine the effect of semi-automatic operation on the cost of supplies and maintenance. There have been few cases of damage to equipment due to failure of protective devices which might have been prevented by manual operation. On the other hand, it is the opinion of all who are closely in touch with the operation of the plants that the protective equipment generally is more dependable than man power, and that many mistakes in operation have been prevented by trusting in the relays rather than in human operators. Certainly routine maintenance has been reduced. Major adjustments and repairs are made by a few skilled men and experimenting by poorly informed operators is avoided. The appearance of the stations has been improved; there is less traffic in and out of the stations; less cleaning is required, and there is less wear on floors, furniture and other equipment used by the operators.

Probably no hydro plant now in existence is richer in the history of power development than the old Mill Creek plant, the first to be made semi-automatic, in 1919. Built in 1893, it was a pioneer in the field and a marvel in its day. Three of the original 250-kva. generators, among them serial No. 51 of the General Electric Company, are still in operation. With the advent of semi-automatic operation it again became a pioneer in this new field.

Of the 42 units in seventeen automatic plants, two are fully automatic and capable of restarting without assistance after an interruption. The 40 other units operate without attendance under normal conditions, but must be resynchronized manually after an interruption. Automatic operation of hydro plants involves two engineering problems which are quite distinct. One is the protection of the equipment from overload, overheating and various faults. The second is that of regulating the output.

Protective relays shut down the units in case of excessive armature current, high voltage, low voltage, excessive temperature in bearings or windings, excessive speed, low governor oil pressure, etc. These operations have become standardized during the last few years and are fully described in various published articles and manufacturers' bulletins.

Water control is a problem peculiar to this type of installation and must be worked out to meet the special conditions at each plant. In all of the automatic plants on the Edison system the output must be regulated to use the available water, since there is always a power demand in excess of the capacity of the automatic plants. This is accomplished in a simple manner where the waterwheel is equipped with a governor which controls the unit by changing the flow of water. In such cases a float in the forebay operates through suitable devices, such as the Selsyn motor, to vary the load-limit setting of the governor, while the speed controlling element of the governor is inoperative at normal frequency and comes into play only when the speed is above normal from any cause.



Temperature indicator and relay on bearing of fully automatic 3,500-kva. unit

Results of Automatic Hydro Plant Operation

Number of plants	17
Number of units	42
Total capacity (kva.)	48,150
Average capacity per unit (kva.)	2,800
Number of operators displaced	44
Annual saving in operating labor	$66,000
Annual saving in housing	$10,560
Labor turnover, automatic plants, per cent	7½
Labor turnover, manual plants, per cent	22

Automatic and Semi-Automatic Hydro Generating Plants

Southern California Edison Company, Ltd.

	Number of Units	Rated Capacity (Kva.)	Number of Operators Manual Operation	Number of Operators Automatic Operation
Mill Creek 1	3	750	4	1
Mill Creek 2-3	5	3,250	6	3
Santa Ana River 1	4	3,000	6	3
Santa Ana River 2	2	1,000	4	1
Santa Ana River 3	1	1,500	4	2
Lytle Creek	2	500	4	1
Fontana	2	2,400	4	2
Sierra	2	600	4	2
Ontario 1	3	750		
Ontario 2	1	500	5	2
Ontario 3	1	400		
Azusa	5	1,500	6	3
Kern River 1	4	20,000	12	7
Tule	2	2,500	5	2
Kaweah 1	1	2,500	5	
Kaweah 2	2	3,500	4	4
Kaweah 3	2	3,500	4	
Total seventeen plants	42	48,150	77	33

This type of control makes possible utilizing a permissible small variation of water level in the forebay to effect the full range of control from no load to full load on the unit. Each change in water surface elevation is instantly transmitted to the governor, which immediately moves to a corresponding definite position. These devices have proved to be very satisfactory when they are properly selected as to torque and when provision has been made for maintaining the correct relation between float position and governor position during and after operating contingencies which may disturb this relation. Emptying the forebay or taking the unit out of service for repairs are conditions that might disturb this relation.

With many impulse wheels, particularly the older units, governing is accomplished by jet deflectors or deflecting nozzles, the flow being adjusted manually or by means of a motor to meet the changing conditions of water supply and load. The majority of the semi-automatic units on the Edison system are of this type and a special device was developed for their control. A forebay float operates a special control switch, which through suitable relays operates a motor on the needle nozzle to adjust the flow to the amount of water available. With this device the water level in the forebay is maintained approximately constant, the flow being adjusted by the operation of the control equipment to return the float to its neutral position. This system operates very satisfactorily when properly adjusted to the particular conditions at the plant where it is installed.

A precise adjustment of the nozzle opening is necessary to maintain constant forebay level, and since the supply canal and forebay have appreciable storage capacity the water level does not adjust itself immediately to a change in flow at the power plant. A considerable amount of time must be allowed for adjustment of water level between successive changes in flow. The proper amount of the change for each impulse and the duration of the delay for flow adjustment are influenced by several factors, such as size of forebay, amount of change in water supply, etc., and can be determined only by trial for each plant. To meet these conditions and prevent "hunting," the control switch provides for three successive speeds of operation, increasing with the amount of float displacement. A motor-operated interrupter or timing device is introduced in the control circuit to provide the necessary time for adjustment of the forebay level between successive movements of the needle valve. The operation of these devices has been successful and the cost of maintenance insignificant.

Shows 26 per cent saving

A specific study of interest made recently was that of the Borel plant, built on Kern River in 1904. This plant contains five 2,000-kva. units operating under a head of 262 ft. It has an annual output of approximately 54,000,000 kw.-hr. and a minimum capacity of 1,500 kw. Certain replacements were unavoidable in the near future and in connection with these changes the possibility of automatic operation was considered. Several alternatives were possible: The plant might be abandoned and replaced by equivalent steam power; this would involve the addition of 1,500 kw. of steam capacity and additional fuel for the production of 54,000,000 kw.-hr. per year; the capital cost of such steam capacity and present steam production costs were estimated as a basis of comparison of the various alternatives.

The second proposal was the continued operation of the hydro plant without material change in design, but merely making such repairs and replacements as were necessary from time to time. The various replacements were estimated both as to date and cost. The operating costs, with a gradual increase as the plant grew older, were estimated and the present worth of all operating and maintenance costs was computed.

The third plan included equipping the present plant for automatic operation and the maintenance of equipment as in plan No. 2. This involved an estimated reduction in operating expense, which could be determined quite accurately from the records of the other automatic plants on the system. Capital expenditures and present worth of future operation and maintenance costs were computed as before.

The fourth consideration involved the installation of a new automatic unit of 5,000-kw. capacity, automatic equipment of two of the old units and a portion of the replacements necessary if the complete plant were kept in operation. Financial computations were made, but it was necessary to take into consideration the additional output due to the higher efficiency of the proposed new unit.

The fifth plan was the construction of a new plant and abandonment of the old plant.

Comparison of the various estimates of capital cost plus present worth of future operating expenses showed plan No. 4 to be the cheapest and this plan was

adopted. This will add one more to the list of automatic plants of the company and raise the aggregate generating capacity of these plants to 58,000 kw.

Comparison of plan two, providing for manual operation, with plan three, covering automatic operating of the station without material change, gave a good idea of the saving to be expected from automatic operation. This saving was more than 26 per cent of the operating cost of the manually operated plant and was sufficient to repay the cost of installing automatic equipment in about five and a half years.

As refinements in automatic plant control are made further reductions in operating attendance may be made and additional savings in operating costs will result. Electrical devices are more reliable than operators in certain routine functions. Automatic operation not only saves money but relieves the operating force of irksome duties and releases man power for work to which it is better adapted.

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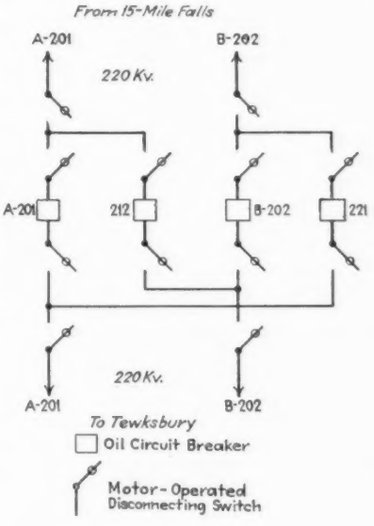
Four Breakers Sectionalize Double-Circuit Line

Maximum flexibility of operation is obtained by the use of only four 220-kv. automatic circuit breakers at the Central New Hampshire switching station of the New England Power Association's Fifteen-Mile Falls-Tewksbury transmission line. At this point provision is made for sectionalizing the two circuits forming this line into four lengths and for cross-connecting the circuits in case of trouble on any single section. The two through circuits are designated by the company as its lines "A-201" and "B-202." The arrangement of circuit breakers illustrated provides a number of combinations of line set-up to meet a variety of operating conditions. Thus, the two circuits can be operated independently or in parallel by closing the proper breakers and disconnects; either circuit can be taken out of service from end to end or the section on either side of the station can be cut free, and either or both circuits can be connected to feed over the remaining section in parallel in case one section is out. Cross-connection can also be effected with any one breaker out of service. Each circuit is provided with motor-operated disconnects and each breaker can be similarly isolated.



Flexible operation assured by simple switching layout

Economy in Fineness of Pulverized Fuels*

By HENRY KREISINGER
Combustion Engineering Corporation, New York, N. Y.

Finely pulverized coal burns quicker than coarse coal. Also high volatile coal ignites and burns quicker than high fixed-carbon coal. There is no need of pulverizing coal to a fineness that will give nearly complete combustion at a rate of heat liberation of 40,000 B.t.u. per cubic foot of combustion space when the construction of the furnace and the fusion of the ash permit a rate of only 15,000 B.t.u. There is no need of pulverizing Illinois coal or Texas lignite as fine as the high-fixed carbon Eastern bituminous coals or anthracite. A large part of the combustible of the Illinois coal and Texas lignite burns as gas, which can be burned quickly, whereas most of the combustible in the Eastern coal and anthracite burns as coke or fixed carbon, which takes more time for combustion.

In addition to the relative contents of volatile matter and fixed carbon the various coals behave differently when heated. The particles of anthracite retain their shape and do not stick together when they collide. Eastern bituminous coals fuse and become sticky. While passing through the stage of fusion, they change their shape, and when two or more particles collide, they may fuse into large pieces. Illinois coal does not generally change shape, does not become sticky and the individual particles stay separate until completely burned. Lignite and the Western sub-bituminous coals crack and disintegrate and the particles break up into a larger number of smaller pieces, which burn more quickly than the larger particles. When sub-bituminous and lignite coals are burned in pulverized form it is comparatively easy to reduce the combustible in flue dust to 1 or 2 per cent. On the other hand, it is considered good combustion when the flue dust from burning Eastern high-fixed carbon bituminous coal contains 20 per cent combustible. The flue dust from anthracite coal-burning installation often contains combustible ingredients to the amount of 50 per cent.

Therefore the fineness of pulverization should to a large extent be determined by the nature of the coal. The accompanying table, prepared from data on six commonly used varieties of coal, gives the fineness for the various coals for the best economic results, considering the cost of pulverization as well as the losses from incomplete combustion.

Economic Fineness for Various Coals

	Per Cent Through 200-Mesh Screen	Per Cent Through 100-Mesh Screen	Per Cent Through 50-Mesh Screen
Anthracite	85	97	100
Eastern low volatile	75	92	98
Eastern high volatile	65	85	97
Illinois	55	80	92
Sub-bituminous	45	75	90
Lignites	35	65	88

**Excerpt from paper, "Development of Pulverized Coal Firing and Study of Combustion," presented at recent national meeting of A.S.M.E. Fuels Division.*

Unemployment Benefit and Insurance Plans

	Unemployment Benefit Plan	Insurance Plan	Retirement Plan
Sangamo Electric Company Springfield, Ill.	Has had mutual benefit association for fifteen years which pays definite amounts to employees kept from work by illness or accident not incidental to their employment.	Company carries group insurance on all employees desiring it, all expenses being borne by company. Plan provides for $500 insurance at end of six months' employment and increases it $100 yearly until it reaches $1,000. Department heads, foremen and assistant foremen have privilege of taking additional insurance up to $3,000 at rate company pays, but at their own expense.	Has no plan of retirement insurance or pension, but has started pension fund and now pays pension to a number of disabled employees who have served company not less than fifteen years. Company now actively working on pension plan involving joint contribution by employees and company.
Lincoln Electric Company, Cleveland, Ohio	Company has no unemployment benefit plan.	Company operates insurance plan at its own expense. Employees eligible after three months' service. Payment is one year's salary at death.	No retirement plan.
Century Electric Company	No unemployment benefit plan.	Yes. Carried by an insurance company, but Century Electric Company pays all cost. Insurance is given each employee who passes a medical examination. Amount is $100 after one calendar quarter continuous service, increasing annually by $50 up to $1,000. Full amount paid at death.	No retirement plan.
Delta Star Electric Company, Chicago	None. Company makes loans to employees in financial difficulties. Loans are retired by deductions from pay envelope.	Group insurance plan. Employees pay most, but company meets any deficit. Full payment at death or total disability or monthly payments at company's option. All employees eligible.	No retirement plan.
Ra lway & Industrial Engineering Company	No plan in operation.	Company carries sickness and life insurance to maximum of $40 per month and $1,500 respectively. Employees and company each pay half.	No retirement plan.
Allis-Chalmers Manufacturing Company	No plan in operation.	Insurance plan is in force under an insurance company financed half by employees and half by company. All employees are eligible who have been with company three months. Minimum is $2,000.	No retirement plan.
Westinghouse Electric & Manufacturing Company	Savings plan with interest at 6 per cent up to $2,000 and 4½ per cent above. Building & Loan Association with interest at 9 per cent. Relief department. Employees pay dues according to salary group. Benefits paid during disability. Company pays all operating costs. Veterans' Association. Co-operative buying committee, etc. Company contributes to the Allegheny County Emergency Association, organized to give employment to those in need.	Group insurance carried for all employees through insurance company. Employees eligible after six months' service. A $500 policy is provided by company without charge and additional amounts depending on salary classification varying from $1,000 to $9,500 on contribution basis at rate of 60 cents per $1,000 per month.	Westinghouse Electric annuity plan. Employees eligible after one year's service. Retirement age gradually reduced from 70 to 65. Company deposits monthly 1.2 per cent of its pay roll. Under this plan employees may increase their annuity by contributions made through salary reductions.
General Electric Company	Unemployment Pension Plan—All employees eligible after one year of service. Contribute 1 per cent of earnings to fund started July, 1930. Company contributes equal sum. Relief and loans may be made from part of the fund. In emergency, when payments from fund equal 2 per cent of earnings of contributors, all employees of the company who are receiving 50 per cent or more of average earnings, whether participants or not, contribute 1 per cent of pay and company equals contributions. Employment Guarantee for Incandescent Lamp Department—All employees on hourly or piecework basis guaranteed 50 weeks' work of 30 hours each for 1931. Participation option 1, but participants must put in a saving fund 1 per cent of weekly earnings, on which company guarantees 5 per cent interest. G. E. Employees' Securities Corporation—Savings plan paying 8 per cent on bonds.	Two separate group policies—one free insurance, in which policies are paid by the company; the other additional insurance the premiums on which are paid by employees. Latter for all employees who have completed one year of continuous service. The amount of additional insurance is based on employee's annual wages or salary. Besides the free group plan ($1,500 maximum) and the additional insurance plan ($2,000 maximum) any employee may secure a larger amount of insurance under the salary allotment plan. This enables employees to buy regular commercial policies on an advantageous basis and to pay premiums by deductions from salary	Pension and additional pension plans. Former started in 1912, gives pension to every employee. By the additional plan employee contributes 1½ per cent or more of his earnings based on age at entrance, increasing his pension on retirement by about 50 per cent. Pensions paid from trust fund. If employee leaves company he receives his money plus interest; if he dies his beneficiary receives it; if he retires he enjoys his pension. About 1,300 on pension rolls now.
Cutler-Hammer, Inc.	Company has no unemployment benefit plan. E.M.B.A. plan gives free medical service to members and dependents and pays 65 per cent of wages in case of absence from non-occupational causes	The company has an arrangement with the Prudential Insurance Company covering a group insurance plan whereby all who have been in the company's employ for six months or more may obtain life and total permanent disability insurance at low cost. Each employee pays 60 cents per $1,000 per month; company pays balance and also costs.	There is no retirement plan in force.
Reliance Electric & Engineering Company	No unemployment benefit plan.	Group insurance plan; premiums paid by company. Employee may take out additional coverage by making small additional payment. Group policy runs from $1,000 to $1,500. All employees eligible after three months' service. Employees also have benefit association, operated by themselves, which carries certain sickness and death benefits.	No retirement plan.

Electrical Manufacturers Adopt Employee Benefit Plans

What progress has the electrical manufacturing industry made in an attempt to stabilize employment?

What insurance, employee benefit and retirement plans has it adopted?

The answers of a representative group to these questions are tabulated on the opposite page

AMERICAN business has become aware of the profound importance of maintaining purchasing power by keeping men at work, providing against sudden death and disability and providing for old age. Business has learned from experience the cumulatively bad effect of insufficient employment—the disastrous consequences not only of the periodic cycles of depression but of the ever-present technological unemployment. Industry has gradually awakened to the value of stabilizing buying power by keeping men at work where possible and by providing for their needs where some unemployment is inevitable.

Whether the various employee plans adopted by industry to meet this need are based on humanitarian motives or "good business" matters not. From a business standpoint, only results and the cost of obtaining them matter.

In regard to unemployment insurance, opinion is divided. A leading electrical manufacturer expresses the following opinion:

"We have been watching the development of unemployment insurance with a great deal of interest. I personally am somewhat in doubt as to the merits of unemployment insurance. It seems to me that this can better be cared for by establishing reserves and providing at least limited employment during periods of depression. In principle, I doubt the wisdom of making payments to employees without receiving some service in return."

In contrast with this view is that expressed by the president of another electrical manufacturing company indicating the seriousness with which he views the problem:

"We are giving a lot of consideration to two things we haven't accomplished, namely, a retirement pension plan and some form of contributory insurance against unemployment. We feel that the latter is really one of the most pressing problems facing industry, not only electrical manufacturers, but all others, for if we should have another period of unemployment such as the present one, without some effort having been made by industry to be prepared adequately to help employees out of work through no fault of their own, I really feel that we may see drastic changes in our entire economic and social system."

No matter what may be one's individual views on unemployment insurance, there can be little difference of opinion on the urgency of the need for some means either of preventing unemployment or of enabling the unemployed to maintain their buying power in periods of stress.

In general principle the various group insurance and retirement provision plans adopted by the electrical manufacturers are along parallel lines. In nearly all cases the employees contribute toward the premiums. Most of the plans are group plans, usually carried through some one or more of the regularly established insurance companies. All of the manufacturers covered in the present inquiry have some insurance plan, and it seems to be the consensus of opinion that this is one phase of employee relations that cannot be neglected.

A much smaller number of the companies studied have adopted a definite retirement plan. The two outstanding examples are the Westinghouse annuity plan and the General Electric pension plan. In both of these cases the company contributes toward the pension or annuity fund, from which payments are made.

Stabilizing employment

A development that has received increasing attention, especially since the inception of the current period of depression, is an attempt to even out the rate of production, to carry on maintenance, construction and improvement work in dull periods; in short, to stabilize employment. What the General Electric Company has done in this direction has been discussed from time to time in these columns. Some of the problems faced by the electrical manufacturer in any attempt to stablize employment were enumerated recently by President Gerard Swope. He said: "It is easiest in a standardized line which does not become obsolescent and does not deteriorate. One such article is the incandescent lamp, where for many years we have been able to avoid unemployment because of seasonal fluctuations by making lamps in the summer time, when fewer lamps are used, storing them and distributing them to our customers in the fall and winter months when the days are shorter.

"The other end of the line, and of course very much

more difficult, is our engineering products, such as large turbines, where, due to the progress of the art or the demands of the customers, no two turbines ordered at different times of the larger sizes are alike, and very little can be done on these engineering products in the way of stabilization of employment. Notwithstanding, on the smaller engineering products, in slack times we do make parts that are used generally and interchangeably and place them in stock. The plan has been worked out throughout the company to further, as far as possible, this policy of stabilization of employment."

Another of the electrical manufacturing organizations, Sangamo Electric Company, has made a thorough study of the whole question of employee relations and has adopted many progressive measures. This company has had a mutual benefit association for more than fifteen years. The plan pays definite amounts to employees kept from work by illness or accidents not incidental to their employment.

While no attempt was made to ascertain the cost of these various plans used by electrical manufacturers, a study of the situation throughout American industry indicates a lack of accurate cost data.

A study of the question made recently by *System* shows statistics for eight of the companies operating such plans: "For the periods between the time when each plan was started and the end of 1928 the contributions to the funds were 0.7 per cent of the payrolls within the same period. During the same period for the same companies the benefits paid were 0.5 per cent of the payroll. . . . The oldest company plan, that of the Dennison Manufacturing Company, during the thirteen years 1916-1928 inclusive, cost 0.4 per cent of the payroll in contributions to the fund and paid 0.3 per cent to the payroll in benefits."

Probably the shortest answer to the question of cost is that no industry can afford not to meet and solve this most important problem. Nothing is more detrimental to efficiency than discontent among employees and nothing cuts into industry's profits more seriously than general unemployment, as recent events have very well illustrated.

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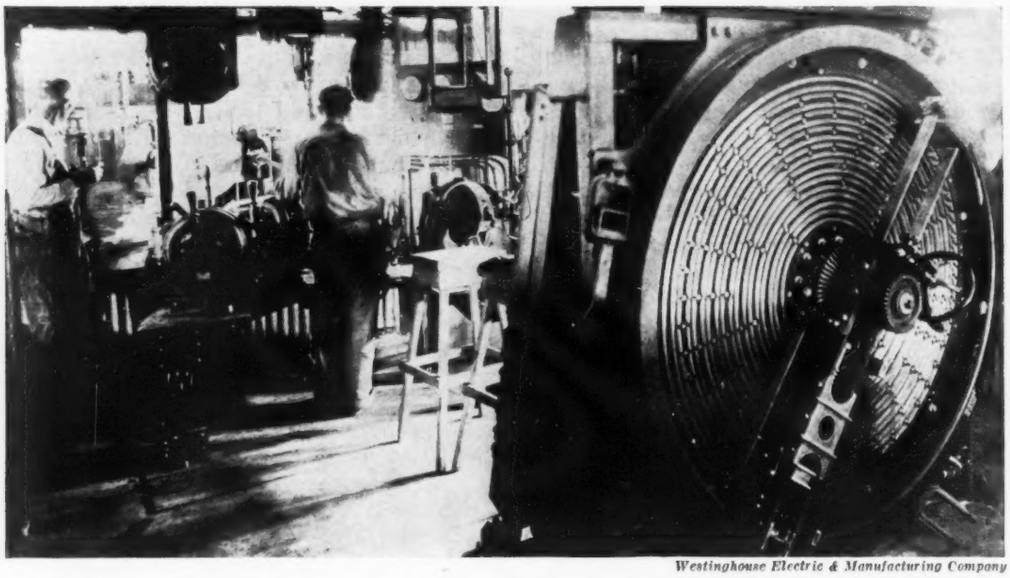
Rolling Steel with Precision



Westinghouse Electric & Manufacturing Company

Automatic screwdown subjects each plate and sheet rolling mill of the Gulf States Steel Company at Alabama City to exactly the appropriate thickness for each draft. The variable voltage control gives very fine speed control and eliminates heavy contacts and large resistors. The acceleration and retardation are rapid but smooth and accurately controlled. The equipment consists of a 70-hp. shunt motor, mill type; a 120-kw. 0-450-volt variable voltage generator driven by a 100-hp. induction motor, and of an automatic screwdown limit switch which is synchronized electrically with the screwdown mechanism.

It has an 8-in. range of roll opening. The drafts in the finishing passes can be varied in 0.01-in. increments; a vernier attachment permits close settings to compensate for changes in the temperature or the roll spring and other variables. The operation is controlled by two men in the mill pulpit. Jacks and plugs are provided for any number of pass settings up to fifteen. A pass selector switch sets the screwdown automatically for each pass and a signal lamp indicates when it is proper to feed the steel into the sheet rolls.

The limit switch (foreground) controls the speed of the screwdown motor, stops it and also reverses it if the mechanism has overtraveled. The limit switch is electrically coupled to the screwdown mechanism by means of two wound-rotor induction motors having three-phase windings in both stator and rotor. The rotor windings are connected by three wires and 220 volts, three-phase, is applied to both stators. This scheme differs from that used for position indicators and transmits a high torque from the transmitter motor to the rotor of the receiver motor when the rotor of the transmitter is subjected to minute displacements.

Rapid Determination of Watt-Hour Meter Register Ratios

By JOHN O. KRAEHENBUEHL and MAX A. FAUCETT
Assistant Professor and Instructor University of Illinois, Respectively

THE checking of the register ratios of watt-hour meters is a regular task for the meter tester. Heretofore this checking required the tester to carry either the various bulletins of the manufacturers or a handbook containing the information of all the manufacturers, which in either case has proved cumbersome and bulky, the handbook being generally more satisfactory, but more likely to get out of date. The design of the various types of meters has followed a slow evolution; this has led to a system of watt-hour and register constants which have a definite basis, and upon this fact are constructed the general formula and table here given. While each manufacturer has his own formula, with a reasonable number of exceptions for his equipment, the general form may be used in considering all manufactured types.

This formula takes into account all the factors controlling the register ratio—that is, the number of current coils, the current and voltage ratings and the other constants which may be determined from manufacturers' information or tables. The simplicity of the formula lies in the fact that it is based on the 5-amp., 100-volt meter (it will always be necessary to take the voltage rating to the even hundred or thousand).

The general form of the formula is:

$$R_r = \frac{K_r\ N\ 500{,}000}{J\ E\ I\ C\ R_p}$$, in which

R_r = Register ratio.
K_r = Register constant (from the meter).
N = Kw.-hr. of the first dial (from the meter).
J = Number of current coils (from type of meter).
E = Voltage rating—to even hundred or thousand (from the meter).
C = Disk constant—for 5-amp., 100-volt meter of the type considered (from the meter). Note—Disk constant may be in watt-hours or watt-seconds. This variation is covered in the multiplier, R_p.
R_p = Multiplier (from tables for the type of meter).

In order that this relationship may be expressed in tabular form to apply to all types of meters, one part may be separated from the rest and the equation written

$$R_r = F\,\frac{K_r\ N}{E\ I}$$

in which

$$F = \frac{500{,}000}{J\ C\ R_p}$$

This will result in a value for F of some thousands, figures rather cumbersome to handle and by their size increasing the chances of error in calculation. But F may be reduced in size by treating every case, not on the basis of the original formula, but as a special case of the 5-amp., 100-volt meter. The values E and I then turn from ratings into ratios. That is, E becomes the ratio of the voltage rating of the meter under consideration (expressed in even figures of hundreds or thousands) to the voltage rating of the 100-volt, 5-amp. meter. Similarly, I becomes the ratio of the current rating of the meter to the current rating of the 5-amp., 100-volt meter. The values of C and R_p are fixed for each type of meter, while J is the number of current coils in the particular meter and is limited to four in the following way:

1 for the single-phase, two-wire meter (one coil).
2 for the single-phase, three-wire meter (two coils).
2 for the three-phase, two-element meter (two coils).
3 for the three-phase, three-element meter (three coils).
4 for the three-phase, 2½-element meter (four coils).

The values determined for the factors for the various meters manufactured are set down in the table in the four columns headed by J.

Determine the manufacturer, type and sub-type of the meter and under the proper value of J will be found the correct factor F to use for the 5-amp., 100-volt meter: this substituted in the formula shown under the table will give the register ratio for the meter regardless of the current and voltage rating, it being assumed that the metering installation has been designed as a complete installation. If this is not true, then it is only necessary to determine the multiplier for the transformer arrangement and check the register constant for the meter that is being used with the transformers. The special footnotes indicate the variations encountered in the table and the exceptions indicate designs in which the meters are not built up on the constant of the 5-amp., 100-volt meter. These meters are passing out of the service and will not be encountered very often.

The table has the advantage that new types can be listed under the proper factors and thereby kept up to date. The examples here given illustrate the use of the table.

Example No. 1—Meter, Sangamo, type H, single phase, two wire, 150 amp., 110 volts, register constant 1, kw.-hr. first dial 10. (It will be noted that all this information is determined directly from the meter.) This meter has one current coil, and from the table F equals 96.

Substituting in the formula:

$$F = 96,\ K_r = 1,\ N = 10,\ E = \frac{100}{100} = 1,\ I = \frac{150}{5} = 30,$$

$$R_r = \frac{1 \times 10 \times 96}{1 \times 30} = 32$$

Example No. 2—Meter, Duncan, type M2, single phase, three wire, 400 amp., 110/220 volts, register constant 10, kw.-hr. first dial 10.

The three-wire meter may be considered from two viewpoints, either as a single-phase, two-wire meter for 220 volts or as two single-phase meters metering two single-phase loads at 110 volts.

In the first instance the two current coils are in series with the load and, therefore, are equivalent to only one coil, while in the second case the coils must be considered as two separate current coils, metering separate loads if necessary.

Considering the case where the meter is single phase, 220 volts the factor from the table is 40.

Factors for Register Ratio Calculation

Manufacturer	Type	Sub-Type		R_p (Multiplier)	J (Number of Current Coils)			
				R_p	1	2	3	4
Westinghouse	Round	All	1φ and 3φ	10	600	300	.....	.....
	A	All	1φ and 3φ	10	600	300	.....	.....
	B	All (except 5 amp., 110 volt over Ser.) 418,000	*1φ	6⅔	480	240	.....	.....
	C	All (except E over Ser. 158,000)*	1φ	6⅔	480	240	.....	.....
		Plain	3φ	6⅔	.....	240	.....	120
		All except (two element E)† (switchboard previous to)‡	3φ	5	.....	300	.....	150
		Only two-element E above 100 amp.	3φ	5	.....	600	.....	.....
		Switchboard previous to sub-type A Ser. 838,688	1φ and 3φ	3⅓	960	480	.....	.....
	OA	Plain (only those of 5 and 10 amp.)	1φ	12½	240	120	.....	.....
		All and other plain 1φ	1φ and 3φ	6⅔	480	240	160	120
	OB	All	1φ and 3φ	8⅓	360	180	120	90
Sangamo	H	All	1φ and 3φ	50	96	48	32	32
	HC	All	1φ and 3φ	50	60	30	20	20
Se'Co		All	1φ	100	48	24	.....	.....
Duncan	M	All	1φ and 3φ	100	40	20	.....	10
	MD	All	1φ and 3φ	75	40	20	13⅓	10
Fort Wayne	K	Above Ser. No. 345,000	1φ	100	40	20	.....	.....
	*	1, 2, 3, 4	1φ and 3φ	100	40	20	.....	10
		5	1φ	100	33⅓	16⅔	.....	.....
General Electric	I	10	1φ	100	40	20	.....	.....
		14 IS-4, 5	1φ	100	33⅓	16⅔	.....	.....
		16, 18	1φ	100	16⅔	8⅓	.....	.....
	D	6, 7, 9 DS-6, 7	3φ	100	.....	16⅔	10	10
		(14, 15 . . . DS-19, 20)¶	3φ	100	.....	8⅓	5⅔	5⅔

*These have a register ratio of 4,796.6

†Two-element meters above 100 amp. (Sub. E)

‡Switchboard meters previous to Sub A Ser. 838688

¶ When used with current transformer double F

Exceptions

Sangamo F

Fort Wayne K below Ser. No. 345,000.

General Electric I, 1-8; IS-2, 3; D-3, 4; DS-2, 3, 4

R_r—Register Ratio

$$R_r = \frac{K_r N F}{E I}$$

Factors

F—Factor as above

Kr—Register constant

N—Kw.-hr. first dial

E—Voltage factor (volts per coil divided by 100)

I—Current factor (amperes divided by 5)

Substituting in the formula:

$$F = 40,\ K_r = 10,\ N = 10,\ E = \frac{200}{100} = 2,\ I = \frac{400}{5} = 80,$$

$$R_r = \frac{10 \times 10 \times 40}{2 \times 80} = 25$$

Considering the case where the meter is single phase, 110 volts, which is the case of two single-phase meters measuring three-wire service, the factor from the table is 20.

E now becomes 1 and the formula becomes

$$R_r = \frac{10 \times 10 \times 20}{1 \times 80} = 25$$

Example No. 3—Meter, Sangamo, type HC, three phase, two element, 25 amp., 2,200 volts, register constant 10, kw.-hr. first dial 10. This meter has two current coils, and from the table F equals 30.

Substituting in the formula:

$$F = 30,\ K_r = 10,\ N = 10,\ E = \frac{2{,}000}{100} = 20,\ I = \frac{25}{5} = 5,$$

$$R_r = \frac{10 \times 10 \times 30}{20 \times 5} = 30$$

Example No. 4—Meter, Westinghouse, type C, sub B, three phase, 2½ element, 40 amp., 440 volts, register constant 1, kw.-hr. first dial 100. This meter has four current coils and from the table F equals 150.

Substituting in the formula:

$$F = 150,\ K_r = 1,\ N = 100,\ E = \frac{400}{100} = 4,\ K = \frac{40}{5} = 8,$$

$$R_r = \frac{1 \times 100 \times 150}{4 \times 8} = 468.75$$

Example No. 5—Meter, Westinghouse, type OB, three phase, three element, 110 volts, 5 amp., register constant 1, kw.-hr. first dial 10. This meter has three current coils and from the table F equals 120. Since the table is formed on the 5-amp., 100-volt meter the register ratio is simply $10F = 1{,}200$.

Example No. 6—Meter, General Electric, type D-6, three phase, 2½ element, 100 amp., 2,200 volts, using transformers, register constant 100, kw.-hr. first dial 10. This meter has four current coils and the factor from the table is 10; the special marking indicates that the factor is special and would not be a multiple of other values of J.

Substituting in the formula:

$$F = 10,\ K_r = 100,\ N = 10,\ E = \frac{2{,}000}{100} = 20,\ I = \frac{100}{5} = 20,$$

$$R_r = \frac{100 \times 10 \times 10}{20 \times 20} = 25$$

Example No. 7—Meter, General Electric, type D-15, three phase, three element, using transformers, register constant 10, kw.-hr. first dial 10, 50 amp. and 2,300 volts. This meter has three current coils and from the table F equals 5 5/9, but the special footnote states that when this meter is used with current transformers the factor is doubled, therefore the factor to substitute into the formula will be 5 5/9 × 2 = 11 1/9.

Substituting in the formula:

$$F = 11\ 1/9,\ K_r = 10,\ N = 10,\ E = \frac{2{,}000}{100} = 20,\ I = \frac{50}{5} = 10,$$

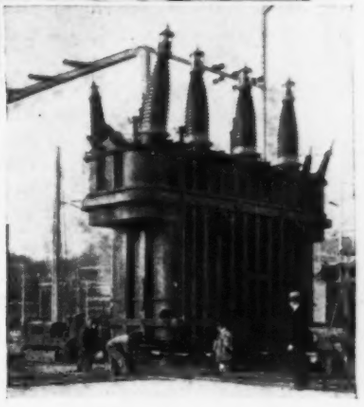
$$R_r = \frac{10 \times 10 \times 11\ 1/9}{20 \times 10} = 5\ 5/9$$

▼

Navigation on Columbia Put Ahead of Power

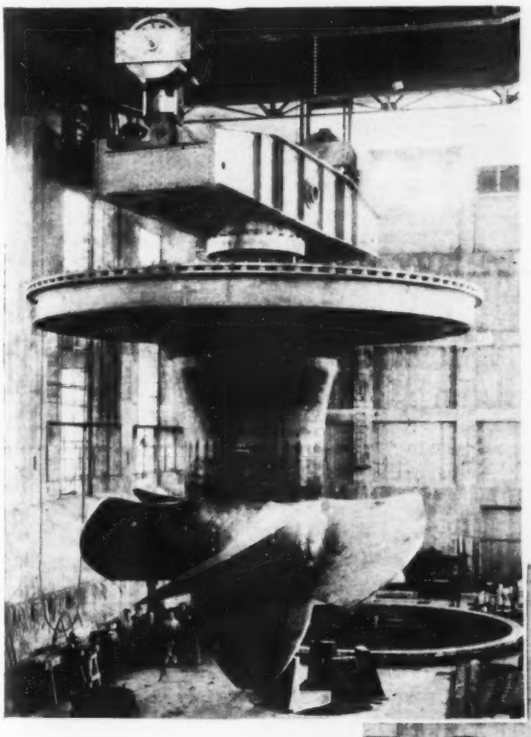
The general trend of a recent survey of views of commercial organizations and chambers of commerce in the Columbia, Snake and Willamette River valleys conducted by the Columbia Valley Association, Portland, Ore., indicates that the most important consideration in the development of the Columbia River is navigation. Development of power on the river was considered as second in importance, with reclamation third.

As a result of the survey the Columbia Valley Association has declared that it will actively push plans for navigation at once.



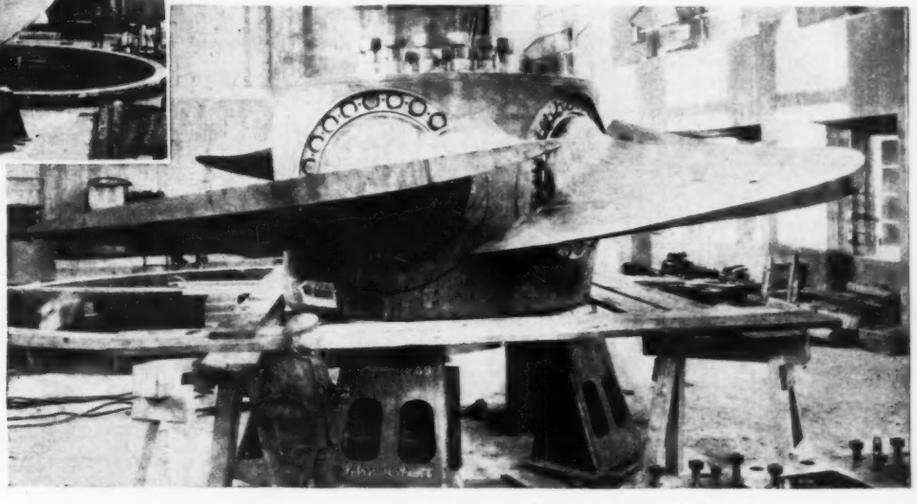
The Upper Rhine Goes to Work

By WAYNE J. HOLMAN and HANS GUBLER



The Rhine is the international boundary near Basle, Switzerland, and provides 35,000 c.f.s. for half the year and 19,500 for the balance. Here four 32,000-kva., 10,500-volt, 50-cycle alternators 44 ft. in diameter, driven by Kaplan turbines 23 ft. in diameter, are being installed in the Ryburg-Schwoerstadt plant to use the 35-ft. head. Two German and two Swiss corporations shared the investment; the two countries shared the orders and will divide the output—on a kilowatt-hour basis rather than on a c.f.s. basis as at Niagara on this continent and elsewhere on the Rhine. Flexible switching makes this possible.

Air-blast switches, said to be the first commercial installation, are used. Outgoing voltages are 45 kv. and 110 kv. to Germany and 135 kv. to Switzerland. Wickets and the Kaplan blades alone are relied upon to control the water, stop logs being used only for repairs. Carbon dioxide will be available for injection to quench generator fires.



Cleaning Stack Gases

By JOHN B. C. KERSHAW

London, England

London stations wash power plant gases to eliminate dust and noxious gases. Experimental developments encouraging. Operating costs high.

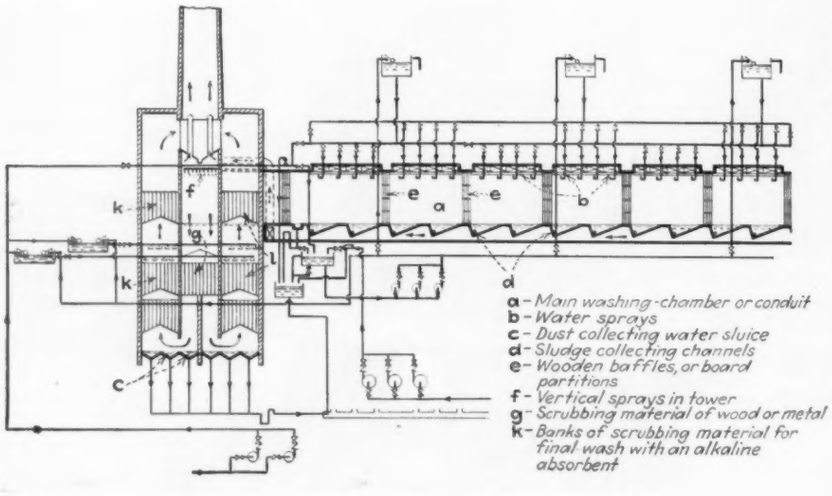
THE majority of the large steam stations have been erected well within the inhabited area of large cities and both London and New York possess several which are operating inside the residential area. The location of these stations inside city limits has brought the problem of cleaning the waste gases into prominence, for the local health authorities in London, no less than in New York, are very much concerned at the prospects of the increased pollution of their atmospheres by the grit, fine dust and sulphur acids which are emitted from the stacks. Use of pulverized fuel for firing the boilers has increased the difficulty, for although smoke is reduced to a minimum when this method of consuming fuel is properly conducted, the high draft required and employed carries considerable quantities of coarse grit and fine dust into the atmosphere, in spite of the methods which are employed generally for trapping the solid impurities. Even when centrifugal grit and dust catchers are employed, on a sufficiently adequate scale, the finer dust particles escape with the waste gases and float for a long time suspended in the atmosphere above the locality where the power station is situated. This fine dust is objectionable for two reasons—not only does it act as a screen for the sun's rays and diminish the health-giving character of the sunlight, but it also acts as a condensing agent for the moisture of the air and causes raindrops to form, which would not have been formed if dust had been absent or in less amount in the atmosphere.

The problem which engineers have to solve in connection with the waste gases of power stations, fired with pulverized fuel and located well within city areas, is therefore that of removing the dust particles and the sulphur acids from these waste gases, at a reasonable cost for the extra plant involved and without any interference with the draft, before they are discharged into the atmosphere. The method of achieving this result, which is now being tried out on a practical scale at many places in England and Germany, is that of washing or scrubbing the gases with water, and various types of apparatus have been devised and are being experimented with for carrying on this cleaning process.

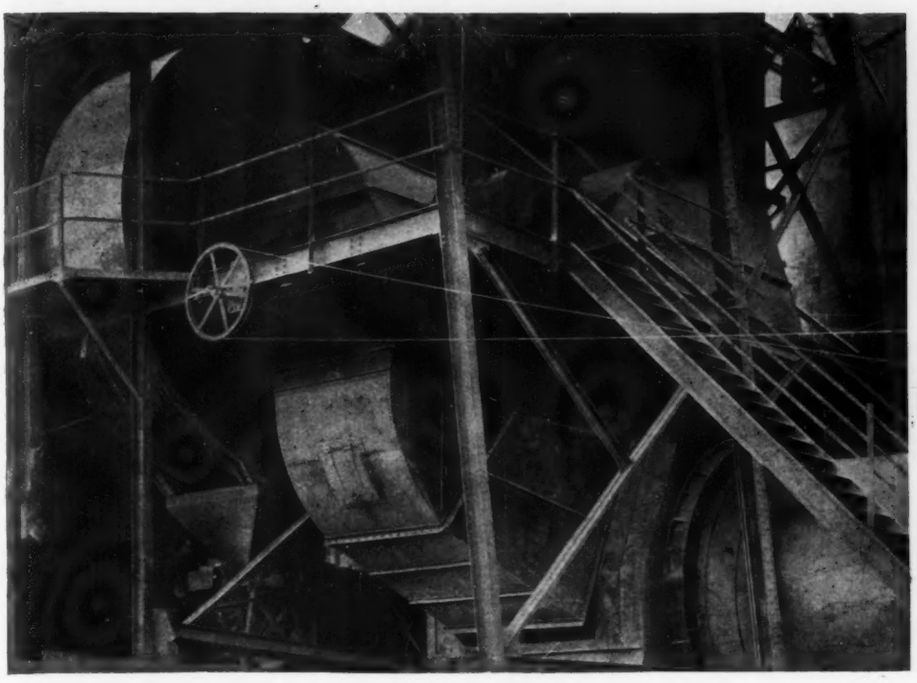
It is customary in all cases, before submitting the waste gases to the washing process, to free them from the coarser particles of grit and coke, or unburned fuel, by passing them through one of the numerous forms of centrifugal apparatus which have been placed on the market for this purpose. This type of apparatus has now been in use for a sufficiently long time for its efficiency to have been well tested and for the running expenses and maintenance costs to have been reduced to a low figure.

Accompanying illustrations show the Davidson grit catcher of the double-shunt type, which is in use at a large number of the larger English power stations, and the type of dust collector known as the "cinder-vane" fan, which performs the double duty of producing the draft and separating the grit or dust in the process.

Turning now to the consideration of the methods of cleansing the gases by means of water sprays, the largest amount of information is available concerning the experimental work carried out by the London Power Company with a plant erected at Grove Road, one of the smaller London electricity generating stations.


a – Main washing-chamber or conduit
b – Water sprays
c – Dust collecting water sluice
d – Sludge collecting channels
e – Wooden baffles, or board partitions
f – Vertical sprays in tower
g – Scrubbing material of wood or metal
k – Banks of scrubbing material for final wash with an alkaline absorbent

London Power Company's design of washing plant from patent specification



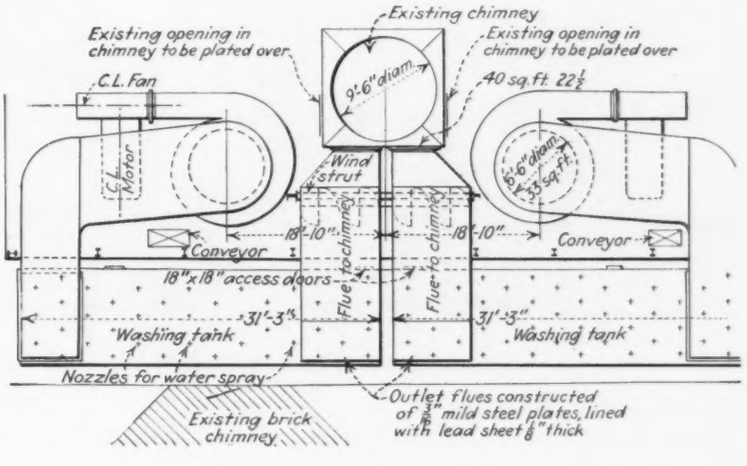
"Cinder-vane" type of grit and dust catcher

The object of these experiments has been to determine the best design and size and the construction details for the larger plant which is being erected at Battersea Park for the London Power Company. During the last eighteen months there has been considerable controversy in the London press concerning the amount of air pollution which may be expected when Battersea Park is in full operation, for it is designed to consume 2,000 tons of pulverized fuel per day, which is equivalent to 700,000 tons per annum. It is natural, therefore, that fears should have been expressed that London's air pollution, both from solid matter and from sulphur acids, will show a considerable increase, and a further cause of complaint has been the location of this station, which is quite near one of the best residential districts of the metropolis.

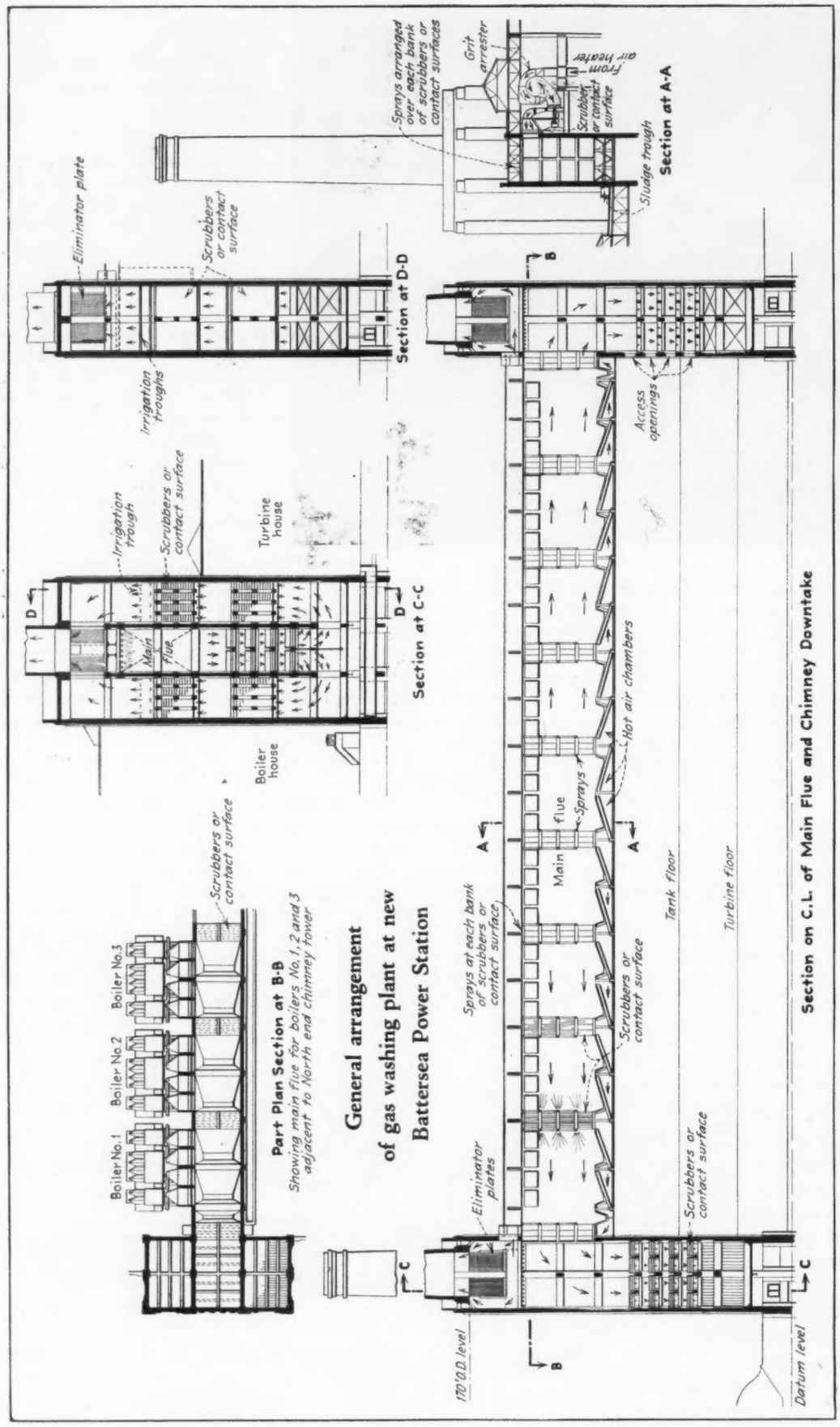
The consumption of 700,000 tons of fuel in this particular area will signify that there will be a discharge of at least 30,000 to 40,000 tons of fine dust into the atmosphere annually, and also of 7,000 tons of sulphur in the form of SO_2 gas. Consequently, unless some satisfactory method and apparatus is devised and is put into operation for cleansing the waste gases, there is certain to be a considerable increase in the amount of air pollution in this district of the metropolis and London's position as the cleanest city of the British Isles will be jeopardized. An even larger station than Battersea Park is also projected in another area of the metropolis, for the Borough Council of Fulham has made plans to enlarge its existing generating station to more than five-fold its present capacity, at an expenditure of more than $25,000,000.

The method and apparatus used for washing the gases at the Grove Road experimental station is based on British Patent No. 334,660, which has been granted to the London Power Company and Dr. S. L. Pearce for improvements in methods and apparatus for the treatment of flue gases. The date of this patent is July, 1929, and of the eleven claims made, the more important are those relating to the use of hot water for spraying the gases and to the use of iron or some other metal as a catalytic agent for converting the SO_2 into SO_3. The general arrangement of the apparatus covered by this patent is shown in the accompanying illustration. This can be understood fully with the aid of the references to the lettering of the diagram. The waste gases pass through the wash chambers and the wash towers in the direction shown by the arrows and the flow of liquid and gases is on the counter-current principle, in order to obtain a maximum absorbent action. Another illustration shows the plant actually erected for the trials at Grove Road.

Details of the experiments carried out with this plant are contained in the interim report of the advisers of the London Power Company, who were E. Ardern, D.Sc., and R. V. Wheeler, D.Sc., and the report was published in November, 1929. The data given in this report confirm the conversion of the greater portion of the SO_2 into SO_3 by the use of hot water and metal plates, although the exact character of the chemical reactions which lead up to this conversion has not yet been elucidated. Efficiencies as high as 96 per cent were obtained in some of the trials of the Grove Road

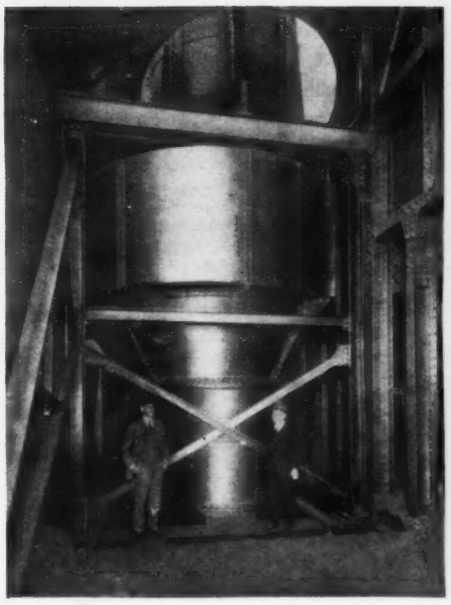


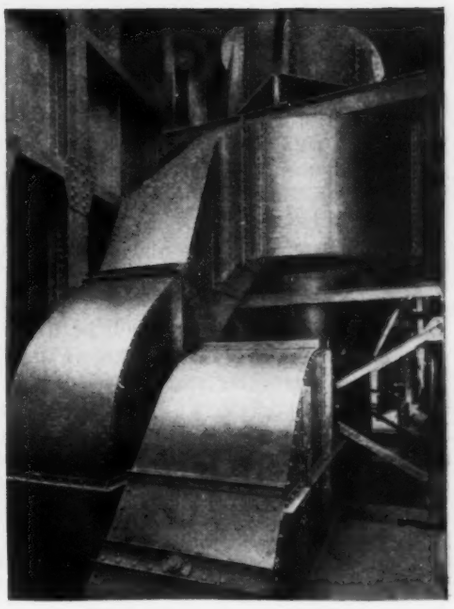
Plan of gas-washing plant at St. Pancras power station



plant, and the report of the government chemist upon the trials says that independent tests carried out by representatives of the government laboratory confirm the removal of 95 per cent of the sulphur acids. A summary of the leading results obtained in these trials is given in the accompanying table, and it will be noticed that the use of an alkali was required in order to obtain the complete removal of the sulphur acids.

The general arrangement of the plant which has been designed for cleaning the gases of the new Battersea power station, as a result of the experience gained with the smaller experimental plant erected at Grove Road, is shown in another illustration. The details of construction can be understood with the aid of the references and explanatory notes on the diagram. Dr. S. L. Pearce, in a paper read at the World Power Conference in Berlin last summer, gave a considerable amount of information relating to the projected plant at Battersea Park, and as the data given in this paper are of considerable importance and value to all electrical engineers who may be in charge of superpower stations part of them are reproduced further along. The three essentials





Davidson grit and dust extractors at Bow Road generating station, London

to success for the treatment of flue gas are as follows:

(a) The placing of sprays along the first flue to increase the humidity of the gases, with surfaces of iron to assist in the conversion of SO_2 into SO_3.

(b) The provision of further sprays and of wetted contact surfaces in the second flue to continue the conversion of SO_2 into SO_3 and to effect the solution of the latter gas and its elimination from the waste gases.

(c) The provision of further surfaces moistened with alkali for the total elimination of sulphur from the gas.

The experimental plant at Grove Road dealt with the gases from a Babcock & Wilcox boiler having an evaporation of 40,000 lb. of steam an hour. With a gas velocity of approximately 3 ft. per second and a contact time of 12 seconds an elimination of 95 to 97 per cent of the sulphur has been obtained with the use of 20 tons of water per ton of coal. Of this total, the removal of 70 per cent was effected in the horizontal portion of the washer and the balance of 30 per cent in the tower section, using an alkaline wash water (strength 10 per cent).

The design for the Battersea power station has been planned to fulfill the following conditions, which are regarded as essential to its successful operation:

(a) A low velocity of the gases.

(b) An initial wetting of the gases by means of atomizers or sprays.

(c) The provision of moistened surfaces of iron or steel, to assist in the conversion of SO_2 into SO_3.

(d) Complete washing of the gases to remove the acids.

(e) Further provision of surfaces wetted with alkaline water, for the total elimination of sulphur acids from the gases.

(f) Ample time of contact between the flue gases and the wash water.

(g) A change of direction in the path of the gases through the apparatus.

(h) The admission of heated dry air at the base of the chimney stacks, in order to avoid condensation of moisture from the super-saturated gases, in cold weather.

(i) Provision for the introduction of suitable catalysts into the spray and wash waters.

(j) Provision of suitable linings for the chambers through which the gases pass.

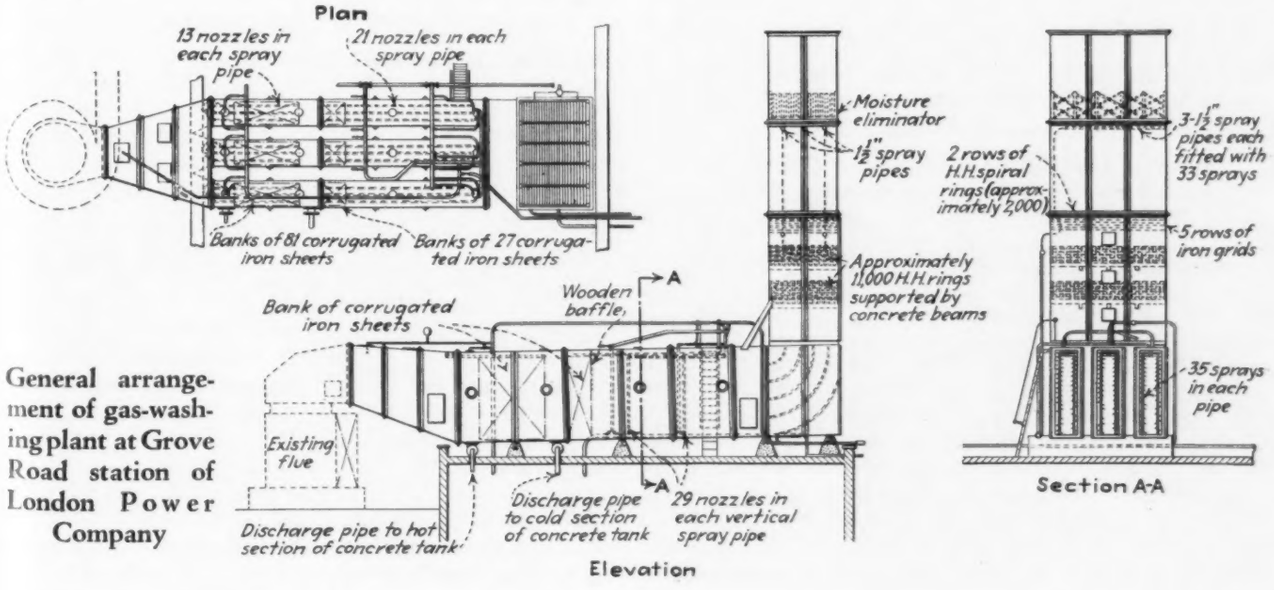
(k) Means for recirculating the spray and wash water or other liquids if desirable.

(l) Means for the removal of sludge and other deposited material.

(m) Means for replacing materials that may be subjected to wasting without stoppage of the plant.

(n) Means for complete oxidation of the effluent, if this should be found necessary.

The design of the Battersea plant permits the use of an over-all figure of 25 tons of water per ton of coal and


Plan
13 nozzles in each spray pipe
21 nozzles in each spray pipe
Banks of 81 corrugated iron sheets
Banks of 27 corrugated iron sheets
Bank of corrugated iron sheets
Wooden baffle
A
Existing flue
Discharge pipe to hot section of concrete tank
Discharge pipe to cold section of concrete tank
29 nozzles in each vertical spray pipe
A
Elevation
Moisture eliminator
1½" spray pipes
2 rows of H.H. spiral rings (approximately 2,000)
Approximately 11,000 H.H. rings supported by concrete beams
3-1½" spray pipes each fitted with 33 sprays
5 rows of iron grids
35 sprays in each pipe
Section A-A

General arrangement of gas-washing plant at Grove Road station of London Power Company

the time of contact allowed for ranges from a minimum of 23 seconds to a maximum of 44 seconds. To secure the necessary catalytic action trials are now being carried out with corrugated plates of the following materials: (a) "Staybrite" steel, (b) calorized steel, (c) a silicon alloy of aluminum, (d) tinned iron. The material will be selected which best resists corrosion and yet secures the necessary catalytic action. A close-grain cast iron or possibly a silicon cast-iron will be used for all pipe work, but in certain situations a vitreous earthenware will be adopted. An alloy of silicon and copper or of cast iron and monel metal will be used for the circulating pumps, and any other parts of machinery in contact with the wash water and sprays of the centrifugal type will be constructed of a similar alloy of silicon and copper.

Cost estimates for gas washing

A careful estimate has been made by the engineers of the London Power Company of the capital outlay and of the operating costs of the gas-cleaning plant which has been designed for the new Battersea station. The estimate, which is based on liberal figures and the use of a limited amount of alkali for the final stage of the washing process, adds 36 cents to the operating costs per ton of coal burned. The writer is not alone in considering that this additional cost is much too high and that it ought to be possible to wash these gases thoroughly, and to remove all harmful constitutents from them before they discharge into the atmosphere, at an additional cost of 24 cents per ton of fuel consumed. If the sulphur could be recovered in some salable form, such as sodium or calcium sulphite, or, preferably, as sodium hyposulphite (for all of which salts there is a good demand), the washing process might be made self-supporting, and the writer quite expects that some interesting developments will occur in the future along these lines.

Another type of gas-washing plant is also being tested upon a practical scale at the King's Road generating station of the Borough of St. Pancras, in London. At this station a patented design of washing apparatus, brought out by the chief electrical engineer of the St. Pancras Borough Council, is in use. The Barron patents have been purchased by the well-known firm of Babcock & Wilcox and the washing plant at King's Road has been supplied and erected by this firm. During a trial of seven weeks at St. Pancras the following results were obtained:

Boiler working hours	1,035
Tons of coal consumed	2,770
Tons of dust and grit collected:	
In grit catchers	67.4
In washing chambers	126.5
Retained in ashpit	6.9
Total ash contents of coal	200.8

Converting these figures into percentages, we find that 33.5 per cent of the ash contents of the fuel were stopped by the Davidson grit catchers, and nearly double this amount, or 63 per cent, by the washing chambers of the Barron apparatus, leaving only 3½ per cent unaccounted for. As regards the efficiency of the St. Pancras washer when employed for the removal of sulphur acids, the chief electrical engineer of the council has reported that the apparatus is just as successful as when used as a dust catcher, but so far as the writer is aware no figures have been published by him in support of this statement. An extension of the washing plant, however, has been ordered by the St. Pancras Borough Council in order that the waste gases from the two remaining boilers, which are fired with pulverized fuel, may be submitted to a similar cleansing process.

As regards the capital outlay, the original estimate for the erection of the gas-washing apparatus and tanks for two of the four boilers using pulverized fuel at this station was $15,000, but the extension of the plant which is now contemplated is to cost $24,480, since much larger tanks are to be employed and their position will be 40 ft. above the ground level, which requires a larger outlay upon stanchions and supports.

Summary of Results of Experimental Trials of Gas-Washing Plant at Grove Road Station of London Power Company in 1930

	Full Load	Half Load	Half Load and Alkali
Coal:			
Lb. per hour	8,630	4,690	4,330
Carbon, per cent	63.2	65.9	65.8
Sulphur, per cent	0.90	0.89	0.84
Gas:			
Cu.ft. per ton coal at 60 deg. F.	375,000	490,000	485,000
Average CO_2 content of inlet gas, per cent.	11.3	8.9	9.1
Temperature of inlet gas, deg. F.	229	231	225
Temperature of outlet gas, deg. F.	75	83	96
Cu.ft. per hour at average temperature of 152 deg. F., 157 deg. F. and 160 deg. F. respectively	1,690,400	1,206,400	1,107,600
Inlet gas, SO_2 m.gms. per litre N.T.P.	0.90	0.57	0.93
SO_3 m.gms. per litre N.T.P.	0.90	0.68	0.49
Total S m.gms. per litre N.T.P.	0.81	0.56	0.665
Total S grains per cu.ft. N.T.P.	0.354	0.245	0.29
Outlet gas, SO_2 m.gms. per litre N.T.P.	0.43	0.13	0.019
SO_3 m.gms. per litre N.T.P.	0.59	0.31	0.026
Total S m.gms. per litre N.T.P.	0.451	0.185	0.02
Total S grains per cu.ft. N.T.P.	0.197	0.081	0.009
Per cent removed SO_2	52	77	98
SO_3	35	54	96
Total S	44	67	97
Water and Effluent:			
Tons per ton of coal	27	50	13½ plus* alkali
Gallons per hour	23,100	23,100	5,845
So_2 grains per gallon	13.4	6.0	28.4
SO_3 grains per gallon	8.0	14.3	42.1
Total S grains per gallon	9.9	8.7	31.0
(or parts per 100,000)	14.1	12.4	44.3
Total Fe grains per gallon	2.5	1.7	8.9
(or parts per 100,000)	3.6	2.4	12.7

*The smaller quantity of water is explained by the use of increased contact surface.

Sulphur Balance Sheet:	Lb.	Lb.	Lb.
Coal S. per hour	77.6	41.7	36.4
Inlet gas per hour	73.0	36.0	38.8
Outlet gas per hour	41.2	11.9	1.2
Effluent per hour	32.6	28.7	39.2
Ash per hour	2.15	0.7	0.7
Column 3: In addition to the water used, alkali was recirculated at the rate of 300 gal. per hour and contained:			
S, grains per gallon 305	....	....	13.1

'These figures are included in the above balance sheet.

Time for Passage of Gas in Free Space in Seconds:			
Horizontal, first section, 11 ft.	2	3	3
Horizontal, second section, 23 ft.	4	6	6
Vertical (effective), 15 ft.	2½	4	4

Political Sabotage and the Power Industry*

By W. C. MULLENDORE

Vice-President Southern California Edison Company, Ltd., Los Angeles, Calif.

WE OF the electric light and power industry have too long refrained from plain speech in dealing with the political saboteur. During a period of years we have been maligned and lied about by a group of destructive agitators whom we could not take seriously because we believed their charges were so outrageously unfair and false that the public would ignore them. In a considerable measure we were wrong in this assumption. We overlooked the effect of constant repetition and the mass inclination first to enjoy, then to repeat and finally to believe sensational stories and charges reflecting upon the honesty of outstanding institutions.

There are those who, from an honest belief in public ownership and socialistic experiences and by honest discussion, attempt to persuade the public to accept their theories. These I am not indicting. Neither am I indicting those who find imperfections in industrial practices and organization and honestly criticise them. The honest and constructive critic is a most useful citizen.

My remarks are directed at those who deal in malicious falsehoods with the deliberate aim of destroying; who employ venomous tactics from hidden and selfish motives. The indictment is for an offense against both property rights and human rights. The offense is one which I have labeled "Political Sabotage." My definition of political sabotage is "the malicious destruction of property under the guise of political activity in the 'public interest.'" Sabotage proper is defined as "the malicious destruction of property by workmen under cover of employment and under the pretense that the destruction occurred through accident or inadvertence."

The saboteur is closely akin to the slanderer. The weapon which he uses is the malignant tongue of slander. The real object and aim is usually the self-aggrandizement of the saboteur himself—the desire to appear as one of the few honest, unselfish and self-sacrificing servants of the public. To cast himself in the rôle which he seeks to play—that of the upright, honest and unselfish public servant—he must discover that those whom he seeks to destroy are venal. To excuse his own lack of constructive accomplishment in the world of affairs he finds that those who have succeeded are knaves and scoundrels. The slander of which I speak is political slander, employed for the selfish purpose of gaining or retaining office, or inspired by an envy and consequent desire to destroy accomplishment beyond the ability of the slanderer.

What of the property sought to be destroyed? Through more than four decades of service to the American public the electric light and power industry has laboriously builded a structure of public good will and confidence. Though intangible in character, it will not be denied that this property right of the industry is its most valuable asset. The electric utility industry is an intimate part of every community it serves. Upon the confidence of the public in its fairness and probity depends its very life, because from the public come both the funds with which it meets its capital needs and the patronage that enables it to exist. Destroy this public confidence and you have destroyed the industry.

Let me present just a little of the available evidence showing, first, the methods and then the motive of those who would destroy this greatest asset of our industry. As a first count, I direct attention to use of the odious term "Power Trust" to this industry, wholly without justification in fact, and for the malicious purpose of arousing suspicion, distrust and hatred in the minds of the public.

Because there is no "trust" in the power industry; because the term is used falsely, and with knowledge that it is so used, with the purpose of destroying public confidence in the industry, I charge that the use of the term "Power Trust" by those primarily responsible for its use is inspired by deliberate malice.

As a second count, I charge flagrant and outrageous misstatements regarding the conduct of the electric utility business and cite the following examples: In his recent inaugural address Governor Pinchot of Pennsylvania, after charging that the public utilities were attempting to overthrow and dominate the government not only of the United States but of every state in the Union, and to destroy the American form of government, said:

> Back of the public utilities in their attack on our American form of government is the whole fabric of political corruption; the underworld, the protected racketeer and criminals of high and low degree.

**From a recent address before the Commercial Section, Pacific Coast Electrical Association, Los Angeles, Calif.*

This comes from a man intrusted with the high office of Governor of one of the greatest commonwealths of the United States. And it was delivered, not as an extemporaneous speech, but as a carefully prepared inaugural address of that Governor. Under these circumstances it is worse than untrue—it is a deliberate and malicious falsehood containing the direct charge that the public utilities are linked with the worst criminal element in our national life in an attack upon the American form of government.

Again, attention is directed to these statements made by Senator Norris. Speaking in the United States Senate on May 9, 1930, he said, referring to a statement made by the President concerning the great public utilities of the country:

> How can he refer to them as the "great public utilities" in the face of the record of the Federal Trade Commission, where it is shown that for years they have been deceiving and robbing the American people? They have been engaged in politics from top to bottom in every state, dirty politics, disreputable politics, which ought to bring the blush of shame to every patriot. I do not like to have our President referring to them as "great public utilities." They have never done anything except to feather their own nests and deceive the very people who by their pennies contribute to their wealth.

This is said of the electric utility industry, which has extended its service to 20,000,000 American homes and which has, during a period of rising prices, steadily decreased its rates.

Again, Senator Norris said that

> the reason we do not have cheap power in this country is because of the false and misleading propaganda which the power trust has circulated in every school district, in every municipality, among the churches, the lodges, the Boy Scouts and women's clubs, poisoning the minds of our people, and especially of the rising generation, in the effort to create opposition to the kind of government control which has produced such cheap power in Ontario.

And then the Senator delivers the ringing statement,

> that is what stands in the way of happiness and prosperity in millions of American homes today.

Just how careful Senator Norris is of his facts is well illustrated by his statement that

> if we had the Canadian system of government operation we could save the domestic users of electricity $600,000,000 each year.

He referred at that time to the year 1927, when the entire bill for domestic electricity was only $433,000,000.

Such statements as these are not made innocently. It is often said that while these men are wrong and are extremists, they are sincere in that they really believe what they say. They are not sincere. No one can sincerely deal in and constantly repeat such glaring untruths.

Socialism the motive

What is the real purpose and aim served by these attacks? I charge that the immediate aim is the socialization of the electrical industry. The ultimate aim is the socialization of all basic industries of the United States—the substitution of socialism for American individualism in the production and distribution of basic commodities. The destruction of public confidence in, and good will toward, the privately owned electric utilities of this country is a first step, because the saboteurs recognize that until that is destroyed the people will not accept socialism in this industry.

The evidence that socialism is the true motive is clear and convincing. A principal co-worker of Senator Norris, Governor Pinchot and other like-minded public office holders in their onslaught on the electrical industry is Carl D. Thompson, secretary of the Public Ownership League of America. From 1912 to 1916 Thompson was director of the information department and manager of the information bureau in the national office of the Socialist party. The following is quoted from one of the bulletins broadcast by Thompson in that capacity. After claiming that Socialists in the various state legislatures had been directly responsible for enactment of 134 measures into laws, the bulletin says:

> We want no one to think that these sops are socialism. By no means. We want something more than sops. We want the whole soup. We are going to take all the sops they give and thereby gain strength to get the whole feed. Just as the government already owns and operates the postal system, just as the public schools are publicly owned and operated, just as more than 70 nations already own and successfully operate their railway systems, so socialism will push the program until all public utilities—municipal, state and national—are publicly owned and democratically operated. Is this not a practical program? There is nothing else that is practical.

Such is the Thompson program, and for such a program those who collaborate with him must accept responsibility. Another leading organization is the League for Industrial Democracy, organized by a group of Socialists. In 1925 this league organized a committee to prepare plans "for the efficient public ownership of coal and super-power," a committee which "would act as missionaries of the cause of public ownership." Prominent members of this committee were H. S. Raushenbush, McAlister Coleman, Norman Thomas, last Socialist candidate for president, and Senator George W. Norris. After this committee was organized the *New Leader*, official Socialist paper of New York, published an article by Mr. Raushenbush in March, 1927. In this article he says, among other things:

> We (meaning the Socialists) have made three attempts at control (referring to the electrical industry). We have set up municipal plants. Their status is changing and we should face that fact. Outside of the large cities, they can no longer compete in rates and efficiency with the new plants being established by the companies. . . . We have tried regulation by state commission. It has got out of hand. . . . Our third attempt to control at least a part of the industry was in the federal water power act of 1920. . . . This is a step forward. We cannot hope to take over the whole eight-billion-dollar industry successfully even if it was generally thought advisable to do so. . . . If we don't bite off more than we can chew we may have a good deal to chew on in the coming year. . . . Our long-time aim is the abolition of the profit system for private use.

There we have it—the clear statement of the aim and object of the entire movement, of which the socialization of the electrical industry is a first step.

We have before us now the motive, the object and the program of those who are instigating the attack against the electric utilities of the United States. Upon the evidence presented I ask an indictment against leading agitators who are trying to raise a "power issue" in American political life today. I ask an indictment for willful and malicious destruction of property, through the use of the weapon which I term "the malignant tongue of slander." I ask an indictment for an attempt to weaken, if not to destroy, the American Constitution and form of government through the prostitution of high office to the service, not of the public who gave men their office, but of a small group whose purpose it is to undermine our institutions, and to do this not by fair and free discussion, but by maligning and vilifying.

We have too long assumed that this comparatively small group, made up in large part of irresponsible agitators, would not make headway with such a program. We have recently awakened to the fact that the public does not discover falsehoods and misrepresentations for itself, particularly when those misstatements are put forward under the guise of protecting "public interest." We have likewise made a great mistake in assuming that this group is not powerful. It is one of the most powerful groups in the United States, not because of its high standing, but because it has at its command two great newspaper chains which are spreading its doctrines because this propaganda is sensational.

If this onslaught upon American industry and American institutions is to be met, it must be met by each of us who are vitally concerned and who know the facts as individuals. We must become crusaders. We must recognize this dangerous challenge for the insidious, poisonous attack that it is. Let us no longer fool ourselves. Let us inform ourselves of the destructive movements which are going on in our community and in the nation at large. Let us accept this challenge and advance upon this foe, sustained and inspired by the knowledge that our cause is the cause of American institutions—a struggle for the birthright of our people!

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Swedish Railways to Extend Electrification

An important extension of electric operation on Swedish railways is under consideration for early action. The development is to be similar to that of the Stockholm-Goeteborg line. The total length of the lines on which electrification is contemplated is about 532 miles, as follows:

	Miles		Miles
Jaerna-Norrkoepping-Malmoe	340	Falkoeping-Naessjoe	70
Katrinenholm-Aby	25	Arloev-Lomma	3.1
Oerebro-Hallsberg-Mjoelby	76	Malmoe-Trælleborg	19.5

The greater part of the system can be supplied with electric current from the existing substations at Soedertalje, Skoeldinge, Hallsberg and Allingsas, but for the more remote lines new substations will have to be provided. Important reductions in operating costs are hoped for.

An investment of about $5,500,000 will be required for electric equipment. This includes substation equipment, overhead system, feeder cables, electric lighting and sundries.

The project will involve the purchase of 63 main-line locomotives, twelve motor coaches, 21 trailers for station service and eight trailers with accumulator batteries. It is anticipated that the cost of this material will not exceed $2,500,000, with an additional $400,000 for electric car heating. The present steam locomotives are to be used on other lines. About $1,800,000 will be needed for rebuilding communication lines to obviate inductive interference.

The program calls for work to be started July 1, 1931, provided the Swedish parliament votes the necessary credits. Its completion is expected to require three years. The beginning is to be made on the first, second and last named of the lines listed above.

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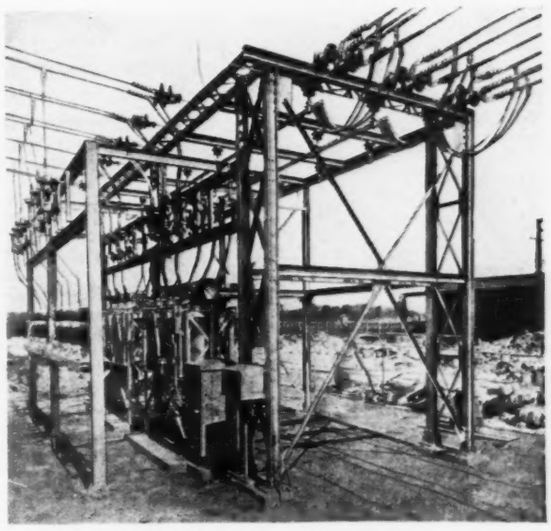
Minimizing Joints in Substation Construction

By J. ELMER HOUSLEY
Alcoa, Tenn.



An industrial substation involving 2,400 amp. at 13,200 volts was simplified by reducing the number of joints necessary. The outgoing leads, which consist of two 1,033,500 circ.mil per phase in two circuits, are brought through a clamp-type dead-end fitting and the end of the cable is fitted with a compression type aluminum clevis terminal which bolts directly to the terminal of the 1,600-amp. disconnecting switch. The busbar used between the disconnects and oil circuit breakers and on the main bus is ¼x3-in. aluminum.

The incoming leads are arranged four per phase and are all aluminum cable, 1,033,500 circ.mil. Aluminum fittings are compressed on the cable and similar jumper terminals are compressed on the jumper cables. The contact surfaces are flat and were bolted together after the joint surfaces were coated with red lead.

Similar fittings are used to connect the tap to the lightning arresters. Small disconnect switches are interposed between the line and the arresters.

Connection is made between the disconnect switches and their respective arrester by means of a ¼x2-in. aluminum busbar. This size is used for making a bus on the ground terminals of the bank of arresters and likewise between each arrester and a ground pipe just below its arrester. The ground resistance of the group of ground pipes measures ½ ohm.

Electrical Advertising Means Bu

IT MEANS, in estimated value of energy so used in New York City, roughly $6,500,000 a year, of which $3,000,000 is utilized on Manhattan Island. It means, nationally, $40,000,000 a year for the electric companies. If the electrical advertising men have their way it will mean $1.50 a year for each urban citizen of the nation, for that is the goal which has been set. How is this great business being directed in the face of obstructive legislation, conflicting ideas and ideals and outraged estheticism? Will Fifth Avenue, Broadway or Seventh Avenue win? Fifth Avenue wants dignity, beauty, restraint and quality. Broadway wants display, color, brightness, motion and ingenuity. Seventh Avenue represents a less highly organized or guided element.

These conflicting views, and many others, offered toward the advance of electrical advertising, were brought up at the recent Electrical Advertising Conference held at the Westinghouse Lighting Institute in New York under the auspices of the electrical advertising committee of the National Electric Light Association. This branch of the electrical industry is up on its toes and, while eager to be guided by intelligent public opinion, is out for more business. A potential market for energy of $200,000,000 beckons and if properly approached and wisely handled should yield without offending the public.

Advertising men are active to meet their growing problems in various communities as local groups become more and more conscious of roadside, highway, street and boulevard appearances. A uniform ordinance for electrical advertising, commercial signs and outdoor advertising has already been accepted in 30 cities, contemplated by a dozen or so more, adopted by the Society for Electrical Development, is now under consideration by the N.E.L.A. electrical advertising committee and is likewise being considered by the National Association of Real Estate Boards.

Better, perhaps, than any other method of indicating the thinking of the industry along these lines would be quotations from some of the more significant remarks made at the New York meeting:

CLARENCE L. LAW
General Commercial Manager
New York Edison Company

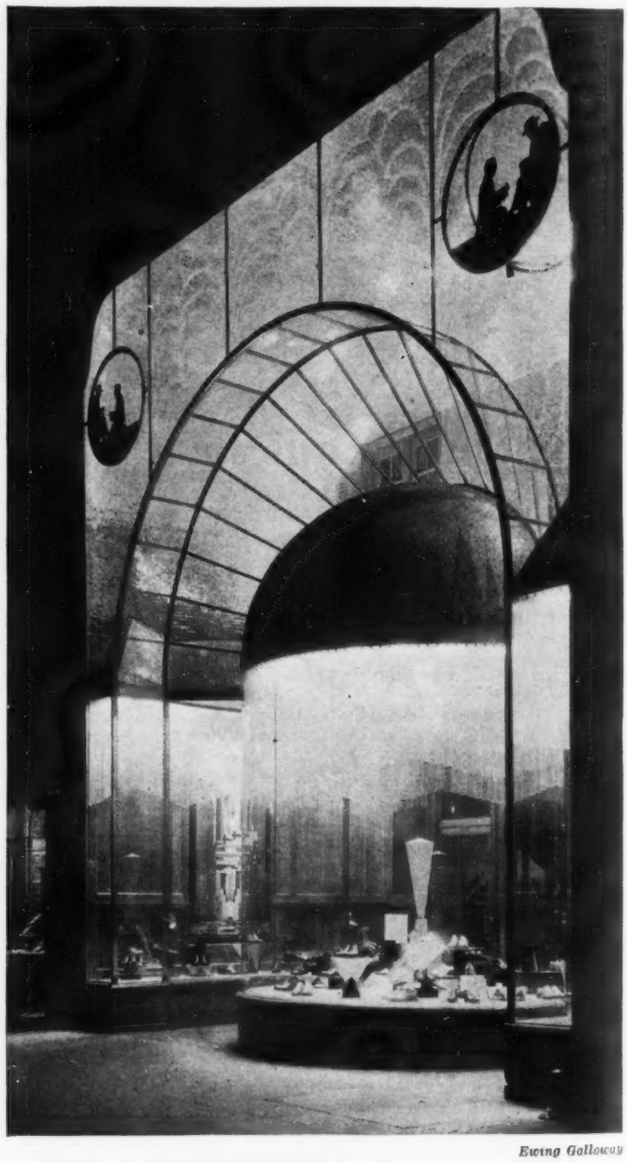
The electric sign is part and parcel of the user's scheme for distribution of products. Convince the prospect that it is not a luxury but a necessity. We cannot just wait for business to come, but must go out and get it.

Three and a half to six hours per day is the normal use of a sign; this beats the residential customer's use and equals or beats the industrial customer's use. The load factor for an electric sign is 25 per cent, as against 10 per cent for the industrial customer and 4 per cent for the householder.

It is estimated that the present yearly revenue from the sale of energy for use in electrical advertising amounts to $6,500,000 in New York City and that $3,000,000 of this is expended on Manhattan island.

S. N. HOLLIDAY
General Outdoor Advertising Company

The overzealous use of this advertising medium is departing. Illuminated signs and posters now appear in 18,000 towns in the United States and every town of



Ewing Galloway

Will the standard be that of N

Business

50,000 population or over is represented in this form of advertising. The requisites of a good illuminated poster sign are beauty, novelty or ingenuity; an idea must dominate. The surface has hardly been scratched in development and extension of outdoor advertising.

S. E. DOANE
Chief Engineer
National Lamp Works of General Electric Company

If there is any liability that the industry faces it is in the bad or unadvised use of signs along roads and highways. We have a duty and obligation to make these signs so attractive that the public will welcome them.

F. H. A. BRANDT
Viking Products Corporation

The constructional requisites of a good sign are safety, efficiency and economy. There are great opportunities in the use of roadside signs using high voltages (say 100 kv.) directly from transmission lines through the adoption of capacitors in securing energy for neon tubes.

R. V. SOMERVILLE
Claude Neon Lights, Inc.

The installed electric sign has done more than any one thing to injure the sign industry. This is due chiefly to failure to give credit to the part that the sign plays in the part of every building.

G. R. LAWALL
National Lamp Works of the General Electric Company

The average small sign lacks composite appeal; it is not beautiful, not unique, not modern, not complete in its message. It should be all these things. A new type of small sign service where the advertiser's message is changed weekly brought a 33 per cent increase in sales to one merchant whose business was suffering from the present conditions. We must educate prospects as to what is good electrical advertising procedure. "Pride appeal" will improve practices and sales.

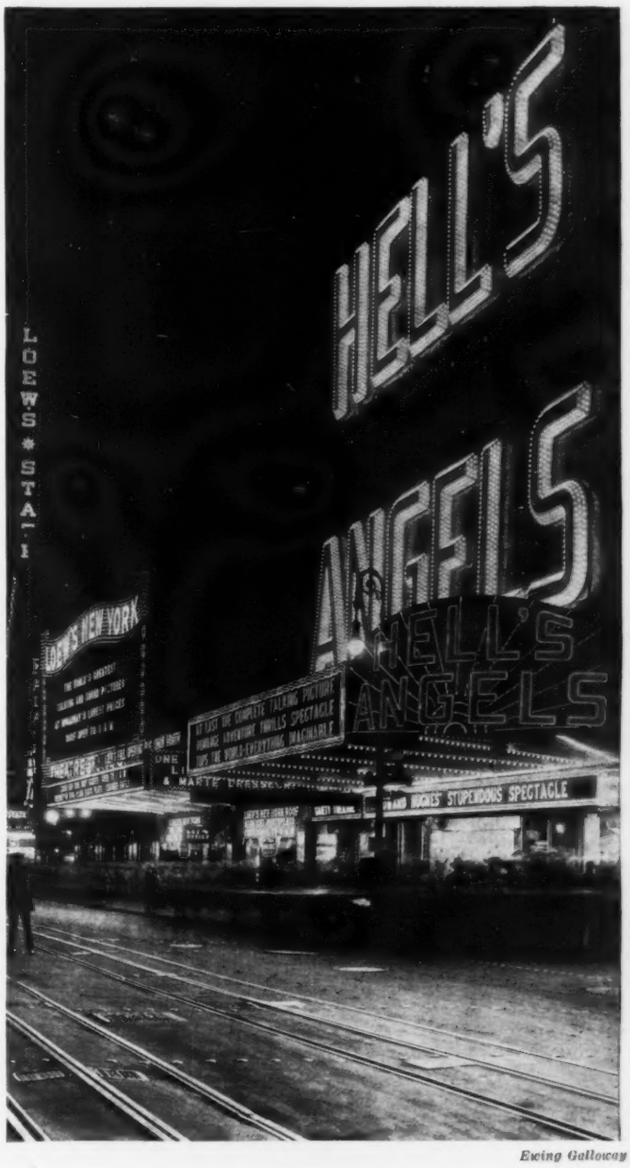
WILLIAM J. PEDRICK
Fifth Avenue Association

Why has Fifth Avenue banned the projecting sign? Why has it darkened some windows? Why has it outlawed garish displays? Business, driven from older locations some years ago by the garish and bizarre and leaving depreciated real estate and rental values behind, moved to Fifth Avenue and organized against the things that beat it. Fifth Avenue bars the bizarre and spectacular and instituted zoning, policing, etc., for self-protection.

Quality is the label attached to Fifth Avenue merchandise and we must protect and improve the market that we already have. The value of a Fifth Avenue address lies in quality merchandise and service. The merchant has two outlets, advertising and window display. There is still a great field for application of electrical ideas to furtherance of Fifth Avenue policy. Crowds which block the windows do not necessarily buy.

Light can do what every other selling medium attempts to do without detracting in any way from the goods itself. Something should be done to improve lighting through education, particularly of merchants, in the adequate use of electric light.

I have seen the magic in the uses of light in window display and I feel that no matter how far we have gone there is still much to be done through the co-operation of engineering and lighting organizations in the proper use of light.



Ewing Galloway

of New York's dignified Fifth Avenue, gay Broadway or—

Fifth Avenue puts out its lights and goes to bed at a respectable hour.

W. T. BLACKWELL
Public Service Electric & Gas Company

We need a code of ethics for the electric sign industry.

C. L. HAROLD
General Sales Agent
Brooklyn Edison Company

If this estheticism, some of it a little mad and too prophetic, does wipe out a large part of the projecting signs in some of our communities it at least gives us some idea of what may be in store for us in the city of the future. We must permanently project ourselves into the new construction period.

JOHN GRATKE
Broadway Association

The impression value of a sign lasts long. People remember those torn down years ago as being quite recent. Where signs are there are retail stores, high rents, high real estate values, etc. Broadway stands firm for the electric sign.

E. C. AUSTIN
Chevrolet Motor Car Company

Every Chrevolet dealer is supposed to have three identifying signs, one indicating that he is a new car dealer, another that he is a used car dealer and a third that he maintains a service department. In 1930 these Chevrolet signs consumed 31,740,000 kw.-hr.; present rate of use is 108,500 kw.-hr. per day. It is estimated that there are 10,000 dealers, each needing three signs, making a total of 30,000, and that the electrification job is at present approximately 25 per cent complete.

Standardized sign equipment with a variation of sizes is necessary to carry out such a plan. It is part of the dealer's contract, subject to branch managers' insistence upon observance, that such signs be used. Maintenance is an important problem and the power company should undertake the job.

The most desirable form of advertising is that which allows you to place the message in the most desirable form before the greatest number of people for the least cost, and that form is electric sign advertising.

C. GALLO
Public Service Electric & Gas Company

Co-operation of sign men, maintenance men, etc., is encouraged in New Jersey. Sometimes it is necessary to refuse sign business when it is thought floodlighting will do a better job than the electric sign does. Architectural co-operation is sought and encouraged.

C. A. BARTON
General Sales Manager
New York & Queens Electric Light & Power Company

I sometimes think that we spend too much on large signs and overlook those of value and aid to small merchants.

GILBERT T. HODGES
President Advertising Federation of America

The electric sign is the only advertising that works or can work 24 hours a day. It is distinctly modern because it has motion, color, etc.

In this country there is spent for electrical advertising $70,000,000 a year, of which $40,000,000 is for electrical energy. This could just as well be $300,000,000 and $200,000,000 for energy if the market were properly developed. There is a total of $2,000,000,000 a year spent for advertising in this country. Why not take advantage of the potentialities in the situation; in other words, the difference between a potential $200,000,000 and the present $40,000,000? If the same condition existed for a commodity, what do you suppose would happen?

As an advertising man, I feel that advertising, whether of the printed or electrical sort, should be sold by advertising.

Ewing Galloway

less formalized Seventh Avenue?

Advertise your medium in other good advertising mediums. Mediums go by style and cycle.

We buy very little in this world through reason. We buy very largely through emotions. Build on an accurate survey of your local market and a concrete plan of action. The truth about advertising should be stressed a little more than it has been.

OLIVER REAGAN
Voorhees, Gmelin & Walker

Modern architects recognize that the electric sign is an essential part of each building just as is heat, elevator service, water, light, power, etc. The control of signs should be left in the architect's hands. Sign men should co-operate rather than hinder.

The sign industry needs capable designers who can understand the architect's problems and work with him. Something has already happened toward this end, it seems. There should be: (1) Order (a place for everything and everything in its proper place). Disorder of projecting signs is due either to architects or sign men. Architects must make provision for proper signs. (2) A close relation between the character of buildings and the signs thereon. A study should be made of the conditions for each installation; some buildings may need no signs at all. (3) Proper space provisions. A really successful sign means having it as much a part of the building as the doors and windows and to be so treated as to be as valid an element as are they. They should, therefore, even influence the design of the building as well as be influenced by it. (4) Proper electrical conditions. Ample provisions should be made at both the top and bottom and rear of windows to give complete flexibility.

The purpose of a sign is to attract or hold the good will of the beholder. Consider adjacent windows and the good or bad will involved through possible misuse of this advertising medium.

W. E. BEEHAN
General Outdoor Advertising Company

There is a propaganda directed against all kinds of signs. There is a move now under way to amend the constitution of the State of New York, placing the control of all outdoor advertising visible from public highways in the hands of the state. The additional menace which this holds is the possibility of placing a high tax, possibly 20 cents per square foot upon the signs in an endeavor to tax them out of business.

The projecting sign is the weakest field; municipalities can govern this very satisfactorily. Signs on buildings should only be regulated in so far as they constitute safety, health or moral hazard. The energy consumption for electric signs in the city of Detroit is $1.50 per capita per year. It is desirable to get good ordinances adopted locally and avoid the necessity of making a sign man a law breaker.

K. A. McINTYRE
Managing Director
Society for Electrical Development

As in other elements the national situation is the summation of local achievement; $1.50 per capita a year in power company revenue is the goal for the electric sign man. In one city where there are 9,500 signs there are 16,000 commercial meters. Some city averages are one sign per 3.6 meters; one sign per 6 to 10 meters. The natural average lies between four and twenty signs per meter. In many cities there is an opportunity for two or three times the present business.

E. E. FREE
Consulting Engineer

The chief elements (psychologically) of attention-arresting value are motion, brightness and incongruity. "Circulation" does not count so much; sign advertisers are interested not in the number of exposures per sign, but in the effect upon the beholder.

There is a great deal of bad advertising done because it is too good. Get down to the attention level of the buyer; 70 per cent of the passers-by are potential customers, 10 per cent are of the superior class and may be wholly unaffected by advertising, while 20 per cent are morons, to whom any appeal is futile.

E. WHITEHORNE
McGraw-Hill Publishing Company, Inc.

Sell electrical advertising to the user on the basis of his personal interest in what it can do for him in solving his sales problems.

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Foot-Candle Effectiveness a Measure for Illumination

By M. LUCKIESH
Director Lighting Research Laboratory, General Electric Company, Cleveland, Ohio

Since the ideal levels of illumination are usually far above present levels, it is necessary to be arbitrary in recommending a level of illumination that affords comfortable vision and at the same time permits its economic attainment. In order to be definite, suppose that the visual task requires the reading of 6-point type printed in black ink on a good white paper. If the experiment is tried in which the reader is instructed to select the minimum level of illumination that appears to afford comfortable vision for extended periods, a 10-ft.-candle level will represent a conservative result. The reasonableness of the demand for 10 ft.-candles for visual work of this type may be tested easily by any one who thinks it is too high.

Now let us compare the visibility of the letters in a telephone directory, for example, with letters of the same size printed on fine book-paper with deep black ink. The reflection factor of the low-grade paper used in the telephone directory is about 57 per cent and that for high-grade book-paper is about 80 per cent. The contrast between the "black" letters and the paper of the telephone directory is about 80 per cent, while the contrast in the other case is 97 per cent. Assuming that the size of the critical details to be seen is about one minute visual angle, it is found from fundamental data, relating size, contrast and brightness, that brightness levels of 5.4 and 2.6 millilamberts, respectively, are required in order to produce equal visibility in the two cases. In order to produce these brightnesses, 8.8 and 3.0 ft.-candles, respectively, are required. The results are summarized in the following table. The data in column A apply to

the telephone directory and those in column B to a book of fine typography:

(For Threshold Visibility)

Kind of Printed Matter	A	B
Reflection factor of paper (per cent)	57	80
Contrast between ink and paper (per cent)	80	97
Brightness required for equal visibility	5.4	2.6
Foot-candles required for threshold visibility	8.8	3.0

It will be noted that the intensity of illumination should be about three times as great upon a page of the telephone directory as upon a page of the book. Since it has been concluded that 10 ft.-candles is about the minimum intensity of illumination that will provide comfortable vision in the case of better printing, it is probable that about 30 ft.-candles would be required for the same degree of ease of reading in the case of the telephone directory. It is interesting to note that our "desirable" level of illumination (10 ft.-candles) is only three times as high as the threshold value for very small objects. This is but one of many cases where the lighting is barely adequate for the best visual conditions and inadequate for many other visual tasks. It is to be emphasized that these data are based on measurements of visibility and do not include considerations such as ease of reading and the conservation of human resources.

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READERS' FORUM

Combating Ice in Northwestern Hydro Plant

To the Editor of the ELECTRICAL WORLD:

Late last fall an interesting and successful experiment was made on a hydro-electric plant to keep ice from forming on the screens and in the turbine during the beginning of cold weather. The installation referred to consists of a small Francis turbine operating a vertical-shaft, direct-connected, d.c. generator rated at 17½ kw., 230 volts and 1,500 r.p.m. at a net head of 38 ft.

The ditch or canal is 3,000 ft. long with a fall of about 4 ft. per thousand and was designed and built for a summer flow of some 11 sec.-ft. of water, part of this flow being for irrigation. During freezing weather the available flow is only about 2½ sec.-ft. and the water flows through the ditch in a series of ripples.

During the first cold weather, with the night temperature about 10 deg. F. above zero, a considerable amount of trouble was caused by the formation of frazil ice on the screens during the hours past midnight. The ripples in the water prevented the water from freezing entirely over in one night and the next day the warm sun would melt any ice which had formed along the banks.

The trouble was not caused by any floating ice, so it was assumed that the frazil ice was carried in the cold water as a chemical solution and it was decided that a means should be used which would take the dissolved ice from the water before it reached the screens. One way to do this would be much the same as rock candy is formed on strings placed in saturated sugar syrups.

At distances of 150 yd. along the ditch open weir dams of willows several inches apart were placed, the upstream points sloping down to the stream bed and downstream ends resting on a pole placed across the ditch.

No more ice formed on the screens or in the turbine, but on the willow screens ice began to form the first night and gradually grew upstream toward the next higher dam until the entire ditch was covered over with ice within a few weeks. The ice formation on the first willow screen was a great deal more than on any of the others and caused the water to rise 2 ft. and back up enough to almost flow over a flood-water spillway. On the other screens the water backed up about 6 in. above the normal level.

Although this plan was applied to a very small plant, the idea seems possible of application to much larger plants with perhaps a few modifications.

The willow screens will be left in the ditch until spring, since they are now frozen solidly, and later will be of value in holding back the floating ice of the ditch when it breaks up. The ditch has a submerged inlet which will prevent floating ice to enter from the creek.

Crowheart, Wyo. **R. JOHNSON.**

Unfair Taxation

THE main reason that taxes are high today and growing higher is the fact that too much property is exempt from taxation. It is manifestly unfair, for instance, to every taxpayer in state and county that certain municipalities should operate public utility businesses upon which they pay no taxes and which are financed through the sale of tax-exempt bonds. This process unjustly increases the taxes of every citizen in the territory, for the shortage must be made up by the people who do pay taxes.

Taxes are a part of the cost of production, so, obviously, those who can avoid this element of cost have an advantage over all members of society who cannot. In the very nature of things municipal ownership is but a form of local privilege. The avoidance by a local political area of federal taxation through municipal operation of an instrument of production is equivalent to a gift from the national treasury, for the local advantage, by the amount that otherwise would have been paid in income and other taxes had the instrument of production been privately owned. And again, by reason of the state taxes not paid in such a situation the local area in effect is receiving from the state treasury, to the disadvantage of all other localities in the state, an amount of money equal to the state taxes that would have been paid under private operation.—*Kansas City Power & Light Company in Newspaper Advertising.*

Men of the Industry

Francis Hodgkinson Receives British Award

FRANCIS HODGKINSON, noted engineer and authority on steam turbines and marine machinery, has been awarded the Willans Premium, a distinguished British engineering honor, by the Institution of Mechanical Engineers of London.

Mr. Hodgkinson, consulting engineer

of the Westinghouse Electric & Manufacturing Company, has been notified that the award, given for the best paper published in the *Proceedings* of the Institution from 1925 to 1930 inclusive, is being forwarded to him from London in the form of a gold medal, following a recent general meeting of the Institution.

Mr. Hodgkinson, well known in marine circles for many contributions to improvement and efficiency in steam-propelling apparatus and electrical machinery, was formerly associated with the late Sir Charles A. Parsons in his early turbine experiments and development in England. Following a term with the Chilean Navy and engineering work in Peru, he became associated with the Westinghouse company in 1896, at the time of the introduction of the Parsons turbine in this country by George Westinghouse.

On the establishment of the South Philadelphia works of the Westinghouse company in 1916 he was made chief engineer, and in 1926 was appointed consulting mechanical engineer for all branches of the Westinghouse company. The present award of the British engineering society is for a paper entitled "Journal Bearing Practice," which was incorporated in the society's *Proceedings*. Mr. Hodgkinson was born in London in 1867.

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FLOYD L. CARLISLE, chairman of the Niagara-Hudson Power Corporation, has been elected a director of the National City Company, securities affiliate of the National City Bank. Mr. Carlisle became a director of the National City Bank in April of last year.

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C. H. HOWELL, who for the past eight years has been general manager of the Atlantic City Electric Company, has been transferred to New York to join the executive staff of the American Gas & Electric Company. E. A. LEWIS, formerly assistant general manager, succeeds Mr. Howell as general manager at Atlantic City.

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CARL M. GILT, formerly inside plant engineer of the Brooklyn Edison Company, has been appointed outside plant engineer to succeed Wallace B. Kirke, resigned because of ill health. Mr. Gilt is a 1914 graduate of the University of Rochester and has taken post-graduate work in engineering at the Massachusetts Institute of Technology and at Union College. Upon completion of his test course with the General Electric Company he spent some time in what is now the central-station department of that company. He became identified with the Brooklyn Edison Company in 1923 as test engineer and in the same year advanced to the position of assistant inside plant engineer. In 1926 he became head of the inside plant bureau. Mr. Gilt's stay with the inside plant bureau covered the period of most of the design work of the Hudson Avenue generating station and the 27,000-volt, 60-cycle substations in Brooklyn. He therefore played a large part in this work and himself sponsored many features of design which have been embodied in these stations. Mr. KIRKE entered the employ of the Brooklyn Edison Company in 1926 as protection engineer following a connection with the New York Edison Company. He was advanced to the position of outside plant engineer later in 1926.

G. H. Stockbridge Made the Recipient of Miller Medal

GEORGE H. STOCKBRIDGE, transmission engineer of the Southern California Edison Company, Ltd., has been awarded the John B. Miller distinguished service medal for outstanding accomplishments during his long career with the company. Mr. Miller is chairman of the Edison company and inaugurated the award in 1928, with its presentation for the first time to R. H. Ballard, president of the company.

The notable accomplishments of Mr. Stockbridge, enumerated in a resolution of the executive committee of the company, which joined with Mr. Miller in commending Mr. Stockbridge, are: Perfection by him of the first 33,000-volt automatic switch, his perfection of the first reclosing oil switch, the making by him of the first automatic voltage regulator, his devising of the method of phasing lines with the use of a string of insulators, his invention of the vibration damper used on high-tension lines, which overcomes crystallization of the aluminum and copper cables, due to vibration, and thereby effects an enormous saving in the expense of maintenance of this equipment, and the discovery by him of the principal cause of flashovers on the 220-kv. line, preven-

tion of which has greatly improved Edison service.

Mr. Stockbridge retired from active service January 1, 1931, after 28 years with the Edison company. He began his career as a lineman and advanced to various positions of responsibility. He became transmission engineer in 1926.

HOWARD M. NAYLOR, construction engineer with the Kansas Power & Light Company, has been appointed Topeka district manager of the company to succeed George H. Ahlborn, who has assumed new duties in Atchison. A graduate of the University of Kansas, Mr. Naylor has been affiliated with the Kansas utility for almost seven years.

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FREDERICK W. JESSER, secretary of the New York Edison Company, has been elected a director of the corporation. Mr. Jesser has been active in the electrical industry for 42 years. He is also secretary of the Yonkers Electric Light & Power Company, assistant treasurer of the Electrical Testing Laboratories, a vice-president and charter member of the Edison Pioneers and is active in trade and industrial bodies.

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GEORGE H. AHLBORN, formerly Topeka district manager of the Kansas Power & Light Company, has been appointed northeast Kansas district manager for the company with headquarters at Atchison. Prior to associating himself with the Kansas Power & Light Company, five years ago, he was connected with the Kansas Gas & Electric Company at Wichita. Mr. Ahlborn is a graduate of the University of Kansas.

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J. C. DOUGLAS, formerly manager in Sacramento, Calif., for the L. H. Bennett Company, has left San Francisco for South America, where he will be associated with the International General Electric Company, with headquarters in Rio de Janeiro. ROY B. CULP has succeeded Mr. Douglas at Sacramento.

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P. L. TUCKER, who has been supervisor of sales for the Northern Indiana Public Service Company in the Valparaiso district, has been transferred to Warsaw to assume a similar position, succeeding PAUL SMITH, who has been made supervisor of sales at Huntington, Wabash and North Manchester, Ind.

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E. J. HOPPLE, recently appointed member of the Ohio Public Utilities Commission, has been designated as chairman of the commission by Governor George White. He succeeds Frank Geiger, who still remains a member of the commission, along with John Bricker.

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DR. K. TAKATSU, head of the electrotechnical laboratory of the Department of Communications, has been elected president of the Japanese Institute of Electrical Engineers, succeeding Dr. M. Tonegawa.

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HERBERT S. SANDS, consulting electrical engineer of Denver, has been reelected as president of the Denver Chamber of Commerce for a third term.

James D. Ross of Seattle

JAMES D. ROSS, who was summarily removed as superintendent of Seattle's municipal lighting department by Mayor Frank Edwards as an incident in the political contention over the city's Skagit River plant, as reported in last week's ELECTRICAL WORLD, has achieved national distinction since his appointment to that position in 1911. A native of Chatham, Ont., and a graduate of the College Institute of that city in 1890, he taught school for a while, studying electricity in his spare time. In 1898 he crossed Canada on foot, prospecting. From 1901 until 1903 he practiced electrical engineering in Seattle, when he entered the employ of the city of Seattle as electrical engineer, with charge of the design, construction and initial operation of the municipal lighting system.

Mr. Ross is the father of the Skagit

River hydro-electric power project. When private interests bought up the power sites for which the city of Seattle was negotiating, he secretly filed on the Skagit site in the name of the city and went to Washington, D. C., to press his claims. He then headed a campaign in Seattle to direct the vision of the city toward a great industrial future, guiding the project through a series of strenuous political fights. In September, 1924, the first unit of the Skagit was completed. He was named by Senator Norris in a bill introduced in January, 1926, as one of the three directors to supervise construction of the hydro-electric project at Muscle Shoals and has appeared as an expert witness several time before the United States Senate. He is an experimenter and inventor of some note and is the author of several textbooks on electrical subjects. He is in constant demand as a lecturer on municipal ownership of lighting and power in the Northwest.

Mr. Ross is a fellow of the A.I.E.E.

EDWIN S. WEBSTER, JR., who with Chandler Hovey of Boston and Albert H. Gordon of New York has taken over the partnership control of the banking firm of Kidder, Peabody & Company, Boston, is a former vice-president of Stone & Webster, Inc., and former president of the Stone & Webster Investing Corporation. Mr. Webster was educated at Harvard College and the Harvard Graduate School of Business Administration and has been associated with Stone & Webster for six years. His directorships include the Railway & Light Securities Company and Stone & Webster, Inc. Mr. Webster's father, Edwin S. Webster, formed the partnership with Charles A. Stone which was the genesis of the present house, and his grandfather, Frank G. Webster, opened the books of Kidder, Peabody & Company in 1865.

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OBITUARY

A. W. CHILDS, 61 years of age, retired executive of the commercial department of the Southern California Edison Company, died March 14 at his home in Los Angeles after a prolonged period of ill health. He was one of the veterans of the Edison company organization, having joined the company in 1902 as a bookkeeper. He advanced to a number of positions of responsibility and was successively district agent in charge of the company's offices in Pasadena, Long Beach and Redlands. In 1908 he became assistant general agent in the Los Angeles general offices and was made general agent in charge of commercial activities in September, 1928. He retired from active service in June, 1930.

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THOMAS D. BOND, a prominent power sales engineer in the industrial department of Charles H. Tenney & Company, Boston, died in that city on March 13, following an operation. Mr. Bond was 44 years of age, a graduate of the electrical engineering course at the Massachusetts Institute of Technology in 1912, and had been in the employ of the Tenney organization since 1913. His first work was with the General Electric Company at Schenectady, in the testing department, and for a short time he was employed by Stone & Webster at Houghton, Mich., in power sales and construction. He became power sales engineer of the Haverhill Electric Company eighteen years ago, and in 1918 was transferred to the Boston office. Mr. Bond served for five years as secretary and treasurer of the New England Association of Central-Station Power Engineers and was one of the best-liked specialists in his field in the eastern New England territory.

Financial and Statistical News

SIGNS of improvement in general sentiment are gaining headway in the bond market. Utility bonds have shown sustained strength, and what new issues have come along are said to have been absorbed readily. Utility common stocks are not far from the year's high and continue to lead upward movements in the market.

——ELECTRICAL MANUFACTURING STOCKS have more or less discounted the 1930 reports just issued. General Electric had the second largest net-sales-billed total on record, but orders were down 23 per cent and unfilled orders at the end of the year were down 41 per cent. Westinghouse sales billed were down 16.6 per cent, owing partly to a shift in radio sales. Bookings by Allis-Chalmers were down 14.2 per cent to $41,606,196.

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Recent Listings

NEW YORK STOCK EXCHANGE has authorized the listing of 75,000 shares of $6 cumulative dividend preferred stock (no par value) of the Engineers Public Service Company now issued and outstanding. There have been added to the Boston Stock Exchange list 75,000 additional (no par) shares (out of a total authorized issue of 1,000,000 shares) preferred stock, this issue to be designated as $6 cumulative dividend preferred stock.

Five per cent debentures due February 1, 1961, of the North American Company to the amount of $25,000,000 have been authorized for listing by the New York Stock Exchange.

There have also been listed on the New York Stock Exchange first and refunding mortgage gold bonds, 4 per cent series due February 1, 1971, of the Philadelphia Electric Company, to the amount of $40,000,000.

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American & Foreign Power Buys Foreign Properties

ANNOUNCEMENT IS MADE by American & Foreign Power Company, Inc., that it has acquired a controlling interest in United Eastern Agencies, Ltd., of Bombay, India. The minority stock of United Eastern Agencies is owned by prominent Indians residing in Bombay and vicinity, some of whom are also interested with American & Foreign Power Company in Tata Hydro-Electric Agencies, Ltd. American & Foreign Power Company has a one-half interest in Tata Hydro-Electric Agencies, which manages certain hydro-electric companies in the Bombay district, according to information recently disclosed.

United Eastern Agencies recently acquired the managing agency of Poona Electric Supply Company, the managing agency of Broach Electric Supply Company, Ltd., and managing agency of Karachi Electric Supply Company, Ltd.

Electric Bond & Share interests are said to be negotiating for the purchase of extensive properties in Rumania, through the American & Foreign Power Company. No transaction, however, has yet been consummated (March 19), according to officials of Electric Bond & Share Company. The Hydrofina electricity plant is one of the properties for which negotiations are being made.

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New Capital Issues

A $3,500,000 issue of 5 per cent first lien and refunding mortgage gold bonds, series B, was sold this week by Iowa-Nebraska Light & Power Company, part of the United Light & Power system. These bonds, which have a duration of 30 years, were sold at 95 and interest to yield over 5.30 per cent.

Alabama Power Company offered an $8,000,000 issue of 4½ per cent, series of 1967, first and refunding mortagage gold bonds. The issue was placed at 98½ and interest to yield over 4.58 per cent. The proceeds will be used to retire certain floating debt of the company incurred on account of additions and improvements already made to its properties.

An $8,000,000 issue of 5 per cent gold notes, maturing 1936, was offered this week by the Pacific Public Service Company at 99 and accrued interest to yield 5.23 per cent.

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Budgets Near 1930 Basis Despite Depression

FAILURE of general business to recover as promptly as was predicted by many at the beginning of the year has not led the utilities to curtail their construction operations. The majority are proceeding on a basis comparable to that of 1930.

Commonwealth & Southern, for example, will spend more than $45,000,000 in 1931, B. C. Cobb, chairman of the board, states. About $36,000,000 of this, or 80 per cent, will be in the electrical department. The bulk of electrical expenditures will be for additional transmission and distributing facilities to take care of new business and further to improve service.

L. G. Tighe, vice-president and manager of the Akron district of the Ohio Edison Company, announces the expenditure of more than $7,000,000 in the Akron, Youngstown and Springfield districts on expansion projects this year. This, of course, is part of the Commonwealth & Southern total. The budget calls for expenditures in and near Akron totaling $3,181,550. This will pay for a new $1,300,000 electric transmission line from Akron to the company's generating plant at Toronto, Ohio. This is a $2,000,000 project, $700,000 having been spent on it last year. The Akron total also includes approximately $200,000 to be spent for a new district steam-heating plant unit.

Discussing the budget of Public Service Company of Northern Illinois, Samuel Insull, chairman of the board, said:

"It is probably some evidence of the opinion of our management as to what is likely to happen in our own line of business that we are proposing to go ahead on about the same basis of expenditure in 1931 as in 1930." Expenditures made for the improvement of facilities and to take care of the development of the company's business must

be made some time in advance, according to Mr. Insull.

The Consolidated Gas, Electric Light & Power Company of Baltimore, according to Herbert A. Wagner, president, has approved a construction budget for expansion of its properties and plants involving an estimated expenditure of $8,300,000 during 1931. The company's construction for 1930 was the largest in its history and there has been no curtailment of the construction program as a result of the business depression. The estimated expenditures for property additions in its electric division amount to $5,500,000.

Expenditure of $2,000,000 for new equipment and construction work throughout the Virginia Electric & Power Company's system has just been approved by the company's board of directors. This, together with construction work authorized in 1930, but not yet completed, makes the present equipment and construction program for the year 1931 approximately $4,000,000.

Extensions and improvements to its services in south and southwest Texas will entail an investment by the Central Power & Light Company of at least $4,000,000 during 1931, it was revealed in the company's budget, which has just been completed for the coming year. According to E. B. Neiswanger, president and general manager, this large sum of money will be used to improve and extend utility service throughout south and southwest Texas and will not be concentrated in any one section or locality.

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British Electrical Industry Strong Financially

SOME INTERESTING FIGURES with regard to the financial position of the British electrical industry are given in the annual financial and commercial review just issued by the London *Times*. One table indicates that the reports of eleven manufacturing concerns issued in 1930 showed aggregate net profits of $9,525,000, equal to 8.5 per cent of the paid-up capital, as compared with only $8,485,000 and 8.20 per cent in 1929. A second table indicates that a total of $8,735,000, representing 7.1 per cent of paid-up capital, was distributed to the shareholders, as against only $6,570,000 and 6.3 per cent in the preceding year. In a third table it is shown that 82.8 per cent of the net earnings was distributed in dividends and 17.2 per cent retained in the business, the corresponding figures for 1929 being 77.5 per cent and 22.5 per cent.

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January Revenue Off ½ per Cent —Energy Down 8 per Cent

RISING more than $5,000,000 above the December figure, but falling half of 1 per cent short of the record established last year, central-station revenue in the United States in January aggregated $197,210,000, according to returns from operating companies received by the ELECTRICAL WORLD. For the third consecutive time the income has been slightly less than in the corresponding month of the preceding year, while going through virtually the normal seasonal changes.

Operating and maintenance expenses, the reports indicate, have been reduced by a wider margin, leaving the net fractionally higher than in January, 1930. Taxes, depreciation and interest are not here included in the deductions from earnings.

Energy output continues lower than in the preceding winter. It was off 6 per cent in October, 7 in November, 5 in December and 8 in January—evidence that industrial power sales are much below normal. The total output, 7,481,525,000 kw.-hr., was 16 per cent less than the computed normal based on growth prior to 1929.

Water power contributed less than 30 per cent. A year ago the ratio was nearly 35 per cent. The actual output from this source was less than 80 per cent as great as in January, 1930, although there was a slight gain compared with other recent months. The decrease was nearly equal to the change in total output. Fuel-generated energy was only 1.8 per cent less than it was a year ago. This latter decrease was ac-

Regional changes in revenue and output

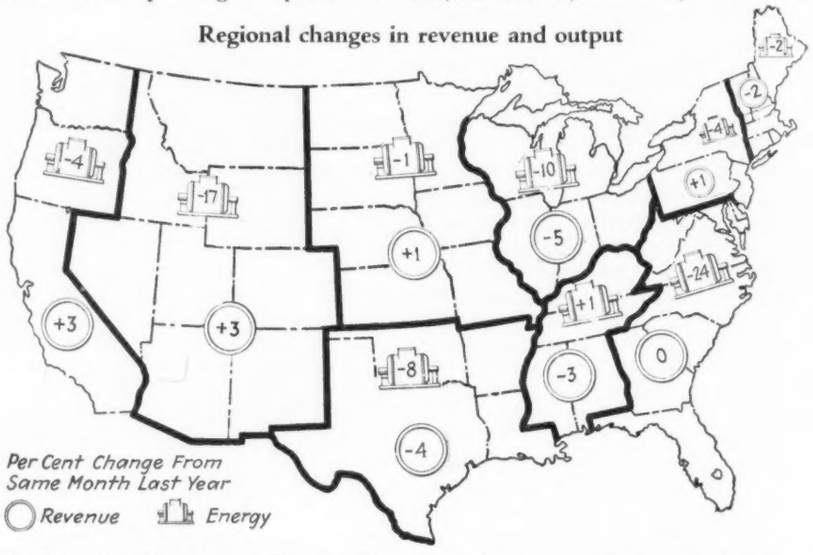


Table I—Central-Station Financial Operations in the United States[1]

Compared with Corresponding Month of Previous Year

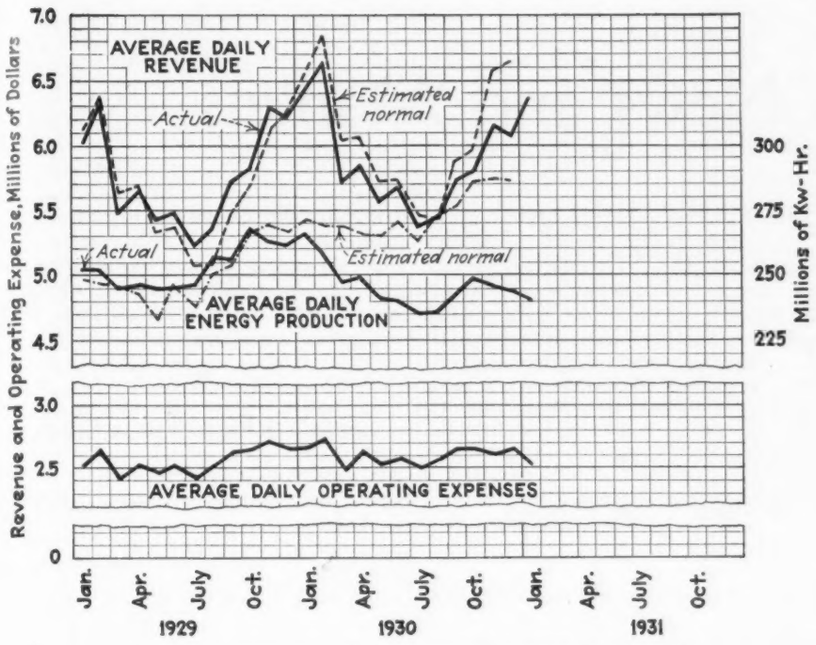
Month	Total Gross Revenue from Sale of Energy*			Total Operating and Maintenance Expense†		
	1930 Thousands	1929 Thousands	Per Cent Inc.	1930 Thousands	1929 Thousands	Per Cent Inc.
October	$182,950	$182,500	+0.2	$81,640	$82,540	—1.1
November	187,340	190,200	—1.5	78,840	80,930	—2.6
December	191,920	192,200	—0.1	82,520	82,680	—0.2
	1931	1930		1931	1930	
January	197,210	198,300	—0.5	77,840	81,480	—4.5

Table II—Central-Station Fuel Consumption in the United States‡

Compared with Corresponding Month of Previous Year

Month 1930	Coal		Oil		Gas	
	Short Tons	Per Cent Increase	Barrels	Per Cent Increase	Thousands Cubic Feet	Per Cent Increase
October	3,686,412	—2.2	865,295	—17.6	10,412,594	—16.0
November	3,414,847	—2.2	764,893	—33.2	9,721,474	—15.4
December	3,548,809	—4.3	824,544	—23.4	10,091,726	+ 0.8
1931						
January	3,424,071	—7.1	749,316	—30.0	9,987,216	+ 1.8

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.
†Do not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions. ‡As collected by U. S. Geological Survey.
(1) The financial statistics for 1929 have been revised as explained on page 665 of the issue of March 29, 1930.



Revenue rose normally; decreased output is unusual

companied by a much larger reduction in fuel consumption. Coal fell 7.1 per cent to 3,424,071 tons; oil, 30 per cent to 749,316 barrels; natural gas, with a 1.8 per cent rise, continued close to 10,000,000,000 cu.ft.

Regional percentages listed in Table IV show little change from the conditions of December. The Eastern manufacturing area again gained in revenue, though modestly, and the Middle Western industrial area decreased, this time by 5 per cent. Others show approximately the same small rise or fall as in the preceding month, except the Mountain States, which shifted from — 8 per cent to + 2.5 per cent.

Changes in energy output were similar to those of December except that the losses were generally larger and some small gains were converted into losses. Along the entire Atlantic seaboard and in the central industrial section the output was less than in December and the year's change was downward compared with the percentages for that month. The regional reductions in hydro-electric energy are especially striking. A 10 per cent increase in intercompany energy sales, now equivalent to a quarter of the total generated, in part reflects the growing ability to combat adverse water conditions by transfers of energy from neighboring systems.

Table III—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1930	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
October	7,686,787	—6.2	2,068,105	—17.9	5,618,682	—0.9	2,190,000	+11.8
November	7,227,716	—6.9	2,010,620	—18.3	5,217,096	—1.6	2,050,000	+ 9.1
December	7,603,785	—4.9	2,183,894	—15.4	5,419,891	+0.1	1,880,000	+ 7.0
1931								
January	7,481,525	—8.3	2,215,047	—20.6	5,266,478	—1.8	1,908,000	+10.0

Table IV—Regional Operations, Revenue and Energy Output in January, 1931

Compared with Corresponding Month of Previous Year

Region	Revenue[1]		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	197,210	—0.5	7,481,525	— 8.3	2,215,047	—20.6	5,266,478	— 1.8
New England	20,090	—1.6	522,885	— 1.6	135,077	—29.6	387,808	+13.9
Middle Atlantic	54,010	+1.4	1,915,854	— 4.0	342,492	—39.8	1,573,362	+10.3
East North Central	47,810	—5.2	1,813,990	—10.1	117,945	—28.0	1,696,045	— 8.5
West North Central	16,360	+1.2	479 050	— 0.9	83,434	— 0.9	395,616	— 0.9
South Atlantic	20,940	+0.4	838,918	—23.6	412,091	—36.8	426,827	— 4.1
East South Central	6,280	—2.6	319,931	+ 1.1	257,604	+ 7.5	62,327	—18.7
West South Central	9,570	—4.0	377,866	— 7.7	7,929	— 4.3	369,937	— 7.7
Mountain	4,810	+2.5	254,376	—16.6	180,648	—24.7	73,728	+12.7
Pacific	17,340	+3.0	958,655	— 3.7	677,827	+ 5.7	280,828	—20.8

* By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central station operations.

(1) The revision of the statistics on revenue is discussed in the issue of March 29, 1930, on page 665.

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Hydro-Electric Progress in Sweden

A BOOKLET HAS recently been published in English by the Swedish Water Power Association describing the hydro-electric development in Sweden during recent years and giving a comprehensive survey of the whole of the country's water-power resources, which are estimated to amount to about 2,200,000 turbine kw. at low water and about 11,700,000 kw. at average flow. It is considered at present that an installation of 6,500,000 kw. is a commercial possibility; in this respect Sweden ranks third among the countries of Europe, being exceeded only by Norway with 12,000,000, kw., and France with 7,900,000 kw. The bulk of the potential water power belongs to private owners and municipalities, but approximately 30 per cent is owned by the state. Of its available resources less than a quarter have so far been developed, the installed turbine capacity being approximately 1,250,000 kw. This figure places Sweden sixth in the list of the hydro-electricity-producing countries of Europe.

During 1929 Sweden's total output of electrical energy amounted to 4,982,000,000 kw.-hr., which, taking the population as 6,100,000, is equivalent to about 815 kw.-hr. per capita. The hydro-electric plants generated about 4,590,000,000 kw.-hr. (92 per cent), while the output of the thermal plants was about 392,000,000 kw.-hr. (8 per cent).

There are in Sweden at present 23 hydro-electric power stations having plant capacities in excess of 10,000 kw., these stations representing about 50 per cent of the country's total turbine installation. The largest station is that of the Royal Board of Waterfalls (Kungl. Vattenfallsstyrelsen) at Trollhättan, the generating capacity being 120,000 kw.; its transmission and distribution system covers an area with a maximum radius of about 87 miles. Next in size is the 72,000-kw. hydro-electric plant at Porjus, also state-owned, which utilizes the water power of the Lulealv and was built primarily to serve the iron-ore districts of Lapland. Of the other large stations the most important are those at Alvkarleby (62,000 kw.) on the Daloken, the Karseforsen (32,500 kw.) on the Lagan, and the Untra (29,600 kw.) on the Lalalven.

Business News and Markets

Canadian Sangamo Electric Changes Set-up

SUPPLEMENTARY LETTERS PATENT have been issued under the seal of the Secretary of State of Canada, dated January 5, 1931, subdividing and converting the 3,000 shares of capital stock of the Sangamo Electric Company of Canada, Ltd., par $100, into 30,000 common shares, without par value, and increasing the capital stock from 30,000 common shares to 44,700 common shares and 5,300 class B shares, all without par value, being an addition of 14,700 common shares and 5,300 class B shares, all without par value, to the present capital stock of the company. The corporate name of the company will be changed to that of Sangamo Company, Ltd.

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Square D Company Earnings Down

THE SQUARE D COMPANY and subsidiaries report for the year ended December, 1930, net profit, including operation of Diamond Electrical Manufacturing Company, Ltd., acquired during 1930, for the full year, of $113,959, equal to $1.13 a share on the class A stock, compared with $503,896 in 1929, equal, after class A stock dividends, to $6.28 a share on the class B stock.

Earnings for 1930 include $20,386 as the company's equity in undivided profits of its affiliated company, Square D Company of Canada, Ltd., comparing with a similar equity in 1929 of $26,327.

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Worthington Pump Nets Over $2,000,000

IN ITS ANNUAL REPORT covering operations in 1930 the Worthington Pump & Machinery Corporation reports net income of $2,056,093, after deduction of $611,758 for depreciation, $171,929 for slow-moving and obsolete inventory items, and after full provision for all taxes. Total billings were 9 per cent less than for the preceding year, while profit on billings from manufacturing and trading was only one-tenth of 1 per cent less than the preceding year.

Current assets at the close of the year were $16,246,050, exclusive of $1,400,294 invested in the preferred capital stocks of the corporation. Current liabilities were $1,358,117. The excess of current assets over current liabilities was $14,887,933, of which $6,635,706 was in cash, certificates of deposit and securities. Unfilled orders at December 31, 1930, amounted to $4,529,060, as compared with $4,140,148 at December 31, 1929.

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Revised Code Allows Metallic Tubing

THE ELECTRICAL committee of the National Fire Prevention Association, at its annual meeting recently, revised Section 508 of the National Electrical Code to allow the use of electric metallic tubing (the new threadless, thin-wall conduit) for concealed as well as open work, including that buried in masonry walls or in concrete, except cinder fill, in the full range of sizes from ½ in. to 2 in. on voltages of 300 or under.

Electric metallic tubing is manufactured by Steel & Tubes, Inc., Cleveland, Ohio, and marketed through leading electrical wholesalers in all parts of the United States under the trade name "Steeltubes."

This modern conduit is said to be but one-third the weight of threaded conduit. It is supplied with compression type, threadless fittings, and is noted for its corrosion resistance, due to its basic open-hearth steel content and cold rolling in manufacture.

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Airport Floodlights Order

AT THE All-American Aircraft Show which is to be held on Detroit's airport in April there will be ample opportunity for night flying. The city of Detroit has ordered from the Westinghouse Electric & Manufacturing Company 49 of its new airport floodlights, which are known as the type ABC-25. This is the largest single order of airport floodlights ever awarded for the lighting of one port. Detroit is not only providing adequate illumination, but also an improved method of lighting the runways, one of which is the longest surfaced runway in this country.

The city of Detroit will have one of the best lighted airports in the country. The direction from which the light is applied and the switching arrangement are such that, regardless of the direction of the wind, pilots can land without facing into the glare of bright light sources.

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Westinghouse 1930 Sales Equal to Five-Year Average

COMPLETE figures for the 1930 operations of the Westinghouse Electric & Manufacturing Company now available show sales billed amounted to $180,283,579, against $216,364,588, a decrease of 16.6 per cent. Some of this is due, of course, to the removal of the manufacture of radio sets and tubes and the rest is due to the decrease in general business.

The year's business is not so discouraging when compared with the 1928 figure, which is, presumably, nearer normal. The 1930 total, even with radio deducted, is only about 4 per cent under the 1928 total, so that the depression year's business is not so far below the average as might appear from the figures of the past two years. In fact, the 1930 total is almost equal to the previous five-year average even after radio has been eliminated.

Earnings statement figures for the past two years follow:

	1930	1929
Gross earnings—Sales billed	$180,283,579	$216,364,588
Cost of sales	171,971,118	194,371,987
Net manufacturing profit	8,312,461	21,992,601
Gross income from all sources	11,886,205	27,316,344
Net income available for dividends and other purposes	11,881,705	27,062,611

The net earnings per share were $4.45. As of December 31, unfilled orders amounted to $40,208,181, which compares with $62,025,399 for the preceding year. During the year four quarterly dividends were declared on the common and participating preferred stocks, each at the rate of 2½ per cent ($1.25 per share), a total for the year of 10 per cent ($5 per share).

Westinghouse Gets Motor Order

A CONTRACT FOR sixteen 1,000-hp. electric motors, to be installed in the Hudson Avenue generating station of the Brooklyn Edison Company as a part of the auxiliary equipment for units in that station, has been awarded to the Westinghouse Electric & Manufacturing Company.

The motors will be used to operate induced draft fans. They are to be multi-speed, of the squirrel cage type, each delivering 1,000 hp. at 1,170 r.p.m. They are designed for operation at 2,300 volts, 60 cycles, and will permit full voltage starting at each speed.

Explosion-tested motors to equip 200 pit car loaders have been shipped by the Westinghouse Electric & Manufacturing Company to the Brown Fayro Company, Johnstown, Pa. An order for twelve circuit breakers has been awarded to the Westinghouse Electric International Company by Ryobi Denki Shokai of Japan for use in the Tokyo district. Two of the circuit breakers are rated at 2,000 amp., 25,000 volts, while the ten others are 1,200 amp., 25,000 volts. The order amounts to approximately $29,000.

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TRADE BRIEFS

Daven Company, successor to Daven Radio Corporation, announces the purchase of the physical assets, patents and trademarks of the former Superior Resistor Corporation.

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Electric Storage Battery Company and Willard Storage Battery Company report for the year ended December 31 net profit of $5,647,300, equal to $6.22 a share on the combined preferred and common stocks, compared with $7,910,904 in 1929, equal to $8.77 a share on the combined stocks.

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The Electric Corporation, Pacific Coast jobber, closed its Seattle branch, located at 321 Occidental Avenue, but will continue to operate in Los Angeles, San Francisco, Oakland, Calif., and Portland, Ore.

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The total value of electric domestic merchandise sales of the Gatineau Electric Light Company, Ltd., subsidiary of the Canadian Hydro-Electric Corporation, Ltd., made a new high record in 1930, exceeding by 5½ per cent the previous high record of 1929, and surpassing 1928 sales by 72 per cent. Merchandise sales in December were 53 per cent greater than in November and 74 per cent higher than in December, 1929.

Employees' ideas, resulting in valuable contributions to the progress and efficiency of the General Electric Company, were recognized and rewarded recently by the Charles A. Coffin Foundation, established by that company in 1922. Awards of merit, consisting of a certificate and a monetary consideration, were made to 38 General Electric men representing many classes of workers and scattered among the company's various factories and commercial offices.

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Le Sauvage & Beardsley, Buffalo, N. Y., have recently been appointed as direct representatives for "Lo-Hed" monorail electric hoists in the districts of Buffalo and Rochester by the American Engineering Company, manufacturer, according to an announcement made recently.

Bell & Eiss, Inc., Minneapolis, Minn., have been appointed representatives for the Northern Equipment Company.

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General Electric Sales Second Largest on Record

NET SALES BILLED by the General Electric Company were the second largest on record, according to figures just received but not yet analyzed. Details of the report will appear in a later issue. Sales billed totaled $376,167,428 against $415,338,094 in 1929, the record year, and $337,189,422 in 1928, the previous high mark.

Orders received by the company during the year were $341,820,312, against $445,802,519 in 1929, and unfilled orders at the end of the year were $56,062,000, a 41 per cent reduction.

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Rush for Exhibit Space Shows Business Confidence

ELECTRICAL manufacturers evidently have confidence that the depression is passing—that they can get business if they go after it. They have shown this belief by their impressive response to the invitation to participate in the exhibit to be held at the fifty-fourth annual convention of the National Electric Light Association at Atlantic City on June 8-12.

For the 1929 convention exhibit all available space on the largest exhibition floor in the country was sold and many exhibitors who applied could not be accommodated. Two important factors contributed to make 1929 a record—the prosperity era was still with us and the celebration to Light's Golden Jubilee was inaugurated at the convention.

It is therefore doubly significant that space contracted for this year up to a recent date compares most favorably with that at the same date in 1929. Only a small amount of space is still available and the association's exhibition committee has reason to believe that this will promptly be contracted for.

Only a few manufacturers who exhibited in 1929 have failed so far to contract for space this year, and an unusually large number will exhibit for the first time. The participation of a larger number of manufacturers of household appliances and the character of the exhibits planned indicate that the increased consumption of kilowatt-hours in domestic service has particularly stimulated manufacturers along these lines.

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New York Metal Prices

	Mar. 11, 1931 Cents per Pound	Mar. 18, 1931 Cents per Pound
Copper, electrolytic	10	10
Lead, Am. S. & R. price	4½	4½
Antimony	7¼	7¼
Nickel, ingot	35	35
Zinc, spots	4.35	4.35
Tin, Straits	27.15	27⅜
Aluminum, 99 per cent.	23.30	23.30

DELINQUENT ELECTRICAL ACCOUNTS

(National Electrical Credit Association)

Number of Accounts Reported

Division	February 1930	February 1931	Per Cent Inc. or Dec.	Two Months 1930	Two Months 1931	Per Cent Inc. or Dec.
New York	348	254	—27.0	656	502	—23.4
Middle and Southern Atlantic	187	138	—26.2	423	267	—36.9
New England	133	102	—23.3	240	184	—23.3
Central	797	647	—18.8	1,632	1,277	—21.8
Total	1,465	1,141	—22.1	2,951	2,230	—24.4

Total Amounts Reported

	February 1930	February 1931	Per Cent Inc. or Dec.	Two Months 1930	Two Months 1931	Per Cent Inc. or Dec.
New York	$58,297	$42,199	—27.6	$131,639	$75,679	—42.5
Middle and Southern Atlantic	24,390	18,771	—23.0	58,622	33,313	—43.2
New England	19,211	10,577	—44.9	41,219	15,818	—61.6
Central	131,278	61,062	—53.5	242,124	120,050	—50.4
Total	$233,176	$132,609	—43.0	$473,604	$244,860	—48.3

Market Conditions

GENERAL business and construction are improving steadily on the Pacific Coast. Power company business during the past week has been at a low level, but substantial orders are anticipated shortly. The marking time process continues in the Middle and Southwest districts and equipment buying has not yet shown any marked increase.

——FIRST QUARTER RESULTS SHOW A MARKED IMPROVEMENT in equipment orders in the Eastern district. Railroad electrification activities constitute a feature of this week's business.

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PACIFIC COAST

—BUSINESS IS IMPROVING *in the San Francisco, Seattle and Los Angeles areas, with more actual ordering in San Francisco and a great potential prospect in Los Angeles for the later spring but little buying just now. Building construction for first two months of 1931 shows Los Angeles decreasing 43 per cent over 1930; San Francisco increasing 37 per cent and Oakland decreasing 7 per cent.*

Power-company machinery ordering was very low last week, though placing of $1,000,000 worth of steam-plant equipment for the city of Pasadena is momentarily expected. The Pacific Gas & Electric Company announces a $350,000 expenditure in the San Joaquin Valley for new substations and relocations, $30,000 for extensions in Shasta territory and $150,000 for the district south of San Jose. The Union Pacific is to install an $80,000 1,500-kva. generating plant for its Hoover Dam site shops and terminal. Other railroad ordering includes a carload of dry batteries and period requirements of tape and wiring supplies.

Power-company purchasing was largely confined to construction and maintenance material, such as two carloads of 32-in. braces and miscellaneous hardware, ten assorted carloads of poles for various small jobs and a $10,000 Westinghouse switchgear equipment for San Francisco. Prospective municipal business in the San Francisco area includes a $7,000 award for street-lighting tops and transformers, a $2,000 award for starting compensators and a $30,000 bid for a year's lamp requirements. Marine orders include $17,000 in Westinghouse condenser and ejector equipment for transport service and a $16,000 ship propulsion outfit. Government work announced covers a $1,500,000 post office for Sacramento and a $700,000 post office for Stockton, work on both to start soon, and a $750,000 addition to the San Francisco Post Office building for federal offices.

Specifications for approximately $50,000 worth of subway transformers and for 80 overhead transformers were approved by the Seattle Board of Public Works, and the city purchasing agent was instructed to call for bids. The anticipated increase in spring sales volume is slow in materializing, although last week's business as regards motor movement was slightly better. Sales reported included 36 machines of from 40 hp. down to a lumber-mill extension in the Puget Sound district, two 75-hp. machines to a lumber mill near Tacoma, 25 machines from 100 hp. down to mills, allied woodworking plants and for ice machines; two 100-hp. motors to the Bremerton Navy Yard for pumps, 25 from 20 hp. down to dealers in Idaho and for eastern Washington irrigation districts, three 150-kva. transformers to an irrigation district, and about $3,000 worth of miscellaneous switchgear to central stations in Portland, Tacoma and Seattle. The city of Tacoma is taking bids until March 23 for its annual supply of globes, and Portland is planning to call for bids for an ornamental lighting system to cost slightly in excess of $45,000.

CONSTRUCTION PROJECTS

Ord Copper Company, Daggett, Calif., plans milling and concentrating plant, with power house and other mechanical units, to cost about $2,500,000. Southern California Edison Company, Los Angeles, has authorized construction of a 66,000-volt transmission line from Saugus to Moorpark, Calif. about 25 miles. San Diego Consolidated Gas & Electric Company, San Diego, Calif., has plans for a power substation to cost about $60,000. Great Western Aero Corporation, Ltd., Santa Barbara, Calif., plans airport buildings and aircraft manufacturing plant to cost close to $100,000. Great Falls and Bozeman, Mont., plan ornamental lighting systems. Brown Palace Hotel Company, Denver, has plans under way for a multi-story addition to cost over $2,000,000, and will install power substation facilities.

SOUTHWEST

—THERE HAS BEEN *no particular change in general business conditions in the St. Louis district, and the volume of sales has been about the same as in the last few weeks.*

Industrials are still buying consistently, and there have been some good-sized shipments of distribution transformers and meters. The only contract worthy of mention is for carrier-current equipment to one of the distributing companies amounting to $50,000.

CONSTRUCTION PROJECTS

Tulsa, Okla., has plans for hangar and airport improvements to cost about $40,000. Continental Oil Company, Ponca City, Okla., will carry out expansion and improvement program at refining plant to cost over $300,000. Constantin Refining Company, Tulsa, Okla., contemplates oil skimming and refining plant at Tyler, Tex., to cost over $250,000. Belton, Tex., has approved plans for an ornamental lighting system. Premier Granite Company, Llano, Tex., contemplates quarrying and finishing plant to cost about $80,000. Houston Oil Refining Company, Houston, Tex., contemplates extensions and improvements in oil refining plant to cost about $250,000.

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MIDDLE WEST

—GENERAL BUSINESS *in the Middle West section appears, for the time being, content to mark time. Conditions in general seem to be improved, although no marked improvement is noticeable or expected. A more optimistic, or at least a less pessimistic, attitude is being evidenced with a determination to "make the best of it."*

The major activities are maintaining their position and a better movement of commodities is observed. A considerable amount of municipal work is being started and some increase in employment is noted. Retail sales are better and should improve with spring in the offing. The various utility companies are proceeding conservatively with as much construction work as it is possible to schedule at this time. The demand for apparatus is somewhat better, a considerable amount being on inquiry. Some of the interesting items placed this week include one 192-circuit calculating table to cost approximately $14,000, 3,000 5-amp. watt-hour meters, 120 demand meters, 10-amp. to 50-amp. capacity, 44 current transformers 50-amp. to 600-amp. capacity and "Mazda" lamps valued at $150,000.

CONSTRUCTION PROJECTS

Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids until March 25 for a surface condenser and other power equipment for naval train-

ing station at Great Lakes, Ill. Commonwealth Edison Company, Chicago, has filed plans for a power substation to cost over $65,000. Northern Aircraft Corporation, Bay City, Mich., plans airport with hangars, floodlighting, etc., near Mount Morris, Mich., to cost close to $85,000. Owens-Illinois Glass Company, Toledo, Ohio, contemplates new plant at Oakland, Calif., to cost close to $1,000,000, with power station and other mechanical units.

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EASTERN

—CONDITIONS CONTINUE *favorable for electrical equipment in the New York market, and marked improvement is noted as the first quarter of the year nears its close. Central-station account is developing strength, with incoming business for transformers and auxiliary substation equipment as well as wire and cable. Industrial demand, likewise, is trending upward, and the improved situation in several of the major lines of trade is reflected in commitments now being placed for early deliveries.*

Railroad electrification activities form a feature of the news of the week, with immediate orders in sight totaling over $20,000,000. Municipal work is another quarter of favorable outlook, and some sizable electrical equipment awards are in sight. The Pennsylvania Railroad is closing for 69 electric locomotives for its electrification program, forming the quota to be purchased in 1931, as part of 240 such units estimated to be required for the complete system. Orders will be divided between the Westinghouse Electric & Manufacturing Company and the General Electric Company, and it is understood that the former has secured a commitment in excess of $10,000,000 for locomotives as well as other primary equipment for the installation. The General Electric share will be equally sizable. It is estimated that about 60,000,000 lb. of copper wire will be required for the complete New York-Philadelphia and suburban district electrification. The Pennsylvania company recently disposed of a bond issue of $50,000,000 to cover necessary financing for the improvement. The Westinghouse company has been awarded a contract by the Atchison, Topeka & Santa Fe Railway Company for electrical equipment for five 400-hp. gas-electric cars, including main and auxiliary generators, controls, relays, traction and other motors, contactors and accessories.

A power company in Connecticut has placed an order with a New York manufacturer for transformers and switchgear totaling $30,000. A central station in northern New York has given an award to a state maker for transformers and accessory equipment costing $115,000. A New York metropolitan central station has contracted with a Pennsylvania manufacturer for a total of sixteen 1,000-hp. motors for use in connection with a generating station improvement program. A total of five bidders tendered figures to the government for motor-generator sets, panels and spare parts for navy yard service, the low bidder being the Continental Electric Company, Newark, N. J., at $16,761.

CONSTRUCTION PROJECTS

Signal Supply Officer, United States Army, Signal Section, Army Base, Brooklyn, N. Y., will receive bids until March 31 for condensers, plugs, sockets, transformers and other supplies (Circular 106); also, until March 30, for 70 to 150 switchboards (Circular 108). Hospital Department, New York, plans two garages and service stations to cost $150,000 and $175,000 respectively. Holmes Airport, Northern Boulevard, Jackson Heights, Queens, plans airship hangar and equipment to cost over $90,000. Ajax Metal Company, Philadelphia, has filed plans for plant addition to cost $150,000. Reading Company (Philadelphia & Reading Railway), Philadelphia, plans power substation in connection with line electrification at Yardley, Pa. United States Engineer Office, Wilmington, Del., will receive bids until April 7, for alternating-current electrical equipment for operating four vertical-lift bridges on Chesapeake & Delaware Canal (Circular 153). Kent Automatic Garage & Washington Market Corporation, Washington, D. C., plans multi-story automobile service, repair and garage building to cost over $3,000,000. General Purchasing Officer, Panama Canal, Washington, D. C., will take bids in near future for hydro-electric power plant and power dam on Chagres River, Canal Zone.

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SOUTHEAST

—ELECTRICAL SUPPLY LINES *in the Southeast are looking up slightly, but while there is a fair amount of business being figured, few orders of anything like satisfactory size are being placed.*

Substation equipment orders aggregating $264,000 have been placed in the last two weeks for a group of affiliated companies, and further business is pending. One company ordered last week $10,625 worth of bare and weatherproof copper wire and $3,850 worth of guy wire. Some other central-station orders were for $4,450 worth of meters and $4,000 worth of distribution transformers. A power contract was signed last week in Georgia which will involve the purchase of a 1,500-kva., 44-kv. substation, the rebuilding of the mill-village distribution and the construction of 1½ miles of 44-kv. line. This load will also involve the construction of a 66-kv. primary station by the supplying company. Steel and iron interests in Alabama placed last week an order for a $35,000 synchronous motor-generator set, and another order from the same state was for a 1,000-hp. synchronous motor. A Georgia textile mill ordered $7,000 worth of loom motors. There is in more or less immediate prospect an order from a Tennessee industrial firm for $7,500 worth of power cable.

CONSTRUCTION PROJECTS

American Suppliers, Inc., Lexington, Ky., a subsidiary of the American Tobacco Company, New York, has approved plans for a storage and distributing plant to cost about $500,000. Central Grayhound Corporation, Memphis, Tenn., plans bus terminal to cost close to $75,000. Clark Monumental Works, Macon, Ga., plans cutting, finishing and processing mill, reported to cost about $60,000. Claxton Coca Cola Bottling Company, Claxton, Ga., has plans for a bottling plant to cost about $65,000.

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NEW ENGLAND

—SMALL-MOTOR ORDERS *noted for the past week reached an exceptionally high level and included unusually large group orders. Inquiries are active and negotiations include orders for one group which aggregate about 7,000 hp. to be used in a Massachusetts paper mill.*

Recently orders for 50 electric industrial trucks were placed and in addition another order for fifteen similar trucks of 2-ton capacity for use in railway terminals. Other special equipment orders of note include 61 electric trucks for Boston service, including 3-ton to 6-ton trucks. Street traffic electric signal units are active, and purchases are noted by eastern Massachusetts cities for new installations. Installation of interior lighting units in the new Simond Steel Industries at Fitchburg include orders for more than 700 fixtures from the General Electric Company. In the past week an order for a 35,000-kw. turbo-generator was placed by the Boston Elevated Railway Company with a prominent manufacturer for the purpose of increasing power for transportation purposes. A general betterment in industrial activities and a noticeable improvement in textile and machine-tool plants forecast increased demands for electrical equipment, according to a prominent manufacturer.

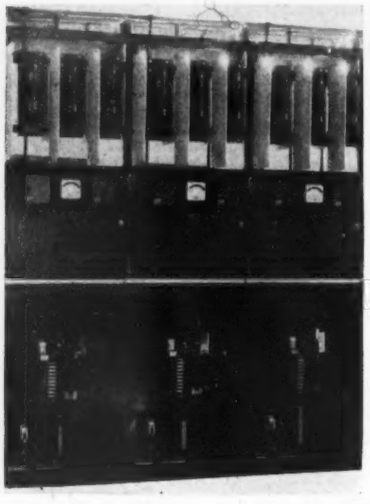
CONSTRUCTION PROJECTS

Boston has plans under way for municipal airport on Governor's Island to cost more than $5,000,000, including administration building, hangars and other units, floodlight system, etc. Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until April 1, for an addition to assembling shop at naval torpedo station, Goat Island, Newport, R. I. (Specification 6437).

New Equipment Available

Assembly Unit for 2,300-Volt Service

AN ASSEMBLED SERVICE UNIT by which any contractor can by connecting service and load have 2,300-volt service readily has been announced by the Engineering Equipment Company, Philadelphia, Pa. The construction of these units permits the assembly of a number of them side by side and connection can be made to a common bus mounted



on top of the frame with a minimum of trouble and expense.

The outfit consists of the following: Disconnecting switches, oil switch, test block, barriers, current transformers, supporting structure, panel and subbase, necessary ground bus and asbestos doors and trims.

Provision is made for lock for disconnect compartment, mounting for service current transformers, for service potential transformers and for service potential fuses.

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Portable-Type Testing Transformers

TESTING TRANSFORMERS TO MEET the demand for laboratory and portable types for obtaining low-voltage alternating current for various test purposes have been put on the market by Siemens & Halske and distributed by Herman H. Sticht & Company, New York. It is claimed they will be found to be very convenient in the meter and testing departments of electric light and power companies, in the signal departments of railroads and also in the testing and research departments of many industrial establishments.

Among the many applications for these transformers may be mentioned the testing of overload relays, fuses, circuit breakers, ammeters, wattmeters, watt-hour meters and current transformers, not to mention many miscellaneous laboratory tests and tests about the plant.

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A HYDRAULIC AUGER designed to eliminate tearing up streets and roads to lay pipes and conduits has been placed on the market by the Hydrauger Corporation, San Francisco, Calif. It is claimed that the "Hydrauger" has succeeded in overcoming the tendency of previous boring machines to drill a gradually declining hole, due to gravitation. The offsetting of this force is one of the outstanding features of the "Hydrauger." An operator can direct its bore with the precision of a marksman at distances of 40 ft., bringing it cut to within 2 or 3 in. of the point at which it is aimed. The machine is capable of boring at distances of 100 ft. or more without the necessity for trenching.

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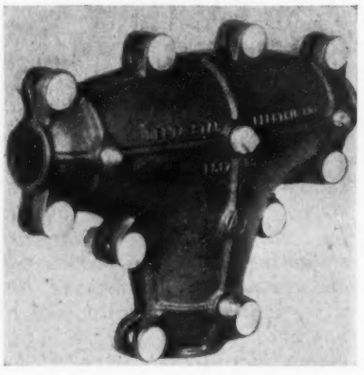
Relay for Controlling Auxiliary Circuits

THE NEW TYPE CS252 RELAY announced by Struthers Dunn, Inc., is a compact switchboard mounting with a glass cover and a form wound coil. It may be furnished for any operating voltage

desired and the contacts will handle a load up to 30 amp. alternating current. The relay has been approved by the Underwriters' Laboratories. The unit has many applications for controlling auxiliary circuits in both the industrial and the public utility fields.

Splice Boxes for All Commercial Cable Sizes

A NEW LINE of splice boxes for all commercial cable sizes, either leaded, armored or trenchlay, in three styles, the two-way splice, the three-way tee and the four-way cross, has been announced by the Delta-Star Electric Company, Chicago, Ill.



Boxes are furnished in plain gray iron, galvanized malleable iron or nonmagnetic corrosion-resisting aluminum alloy adapted to heavy-duty alternating current.

This improved design includes the following features: Large and roomy interiors; large clamping bolts with square locking shoulders, so only one wrench is necessary for installation; ribbed bodies for extra strength and separate end compartments adjacent to central section where armor or protective braid of the cable can be terminated, each furnished with its own filling plug.

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Open-Type Floodlight for 750-1,500-Watt Lamp

AN OPEN-TYPE FLOODLIGHT, identified as AF-20, has been developed by the Westinghouse Electric & Manufacturing Company, at Edgewater Park, Cleveland, Ohio. This new unit is especially suitable for illuminating football and other sport fields. It is also adaptable for lighting parking grounds, freight docks, shipyards, racetracks and gasoline service stations.

These units, when properly installed as to mounting height and spacing, produce very uniform illumination, it is stated. They are suitable for either cross-arm or steel-pole mounting.

The floodlight is designed for use with a 750-watt, a 1,000-watt or a 1,500-watt PS-52 lamp. With any of these lamps a wide beam of diffused light is projected without glare, according to the sponsors of the apparatus.